MARCH 1957 — SIXTY-THIRD YEAR

MACHINERY

Solve Bearing Space Limitation Problems with

NORMA-HOFFMANN

EXTRA LIGHT

XLS Series Precision Bearings

ADVANTAGES

- Have unusually large bores compared to outside diameter
- Provide utmost in accuracy, rigidity, and load capacity — (radial and thrust)
- Are compact, light in weight
- Allow greater freedom in design
- Available in sizes from 1⅜" to 22½" bore

NORMA-HOFFMANN BEARINGS CORPORATION

FOUNDED IN 1911 • STAMFORD, CONNECTICUT

FIELD OFFICES: Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Denver Detroit • Kansas City • Los Angeles • San Francisco • Seattle

NORMA-HOFFMANN *Precision* BEARINGS

BALL • ROLLER • THRUST

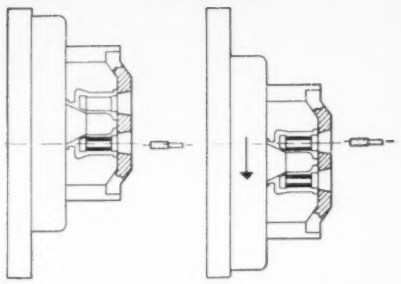
AUTO-INDEXING permits

single chucking for double bore grinding

Manually re-locating a part to grind a *second* bore takes valuable operator time. This time can be saved, in many instances, by the use of an auto-indexing fixture on a Heald Internal Grinder. For example, the Model 271 Size-Matic shown below precision grinds *two* interrupted bores in a universal joint body in a single, fully automatic, 71-second cycle.

The diagrams at right show how both bores of the work are brought in line with the grinding wheel – automatically!

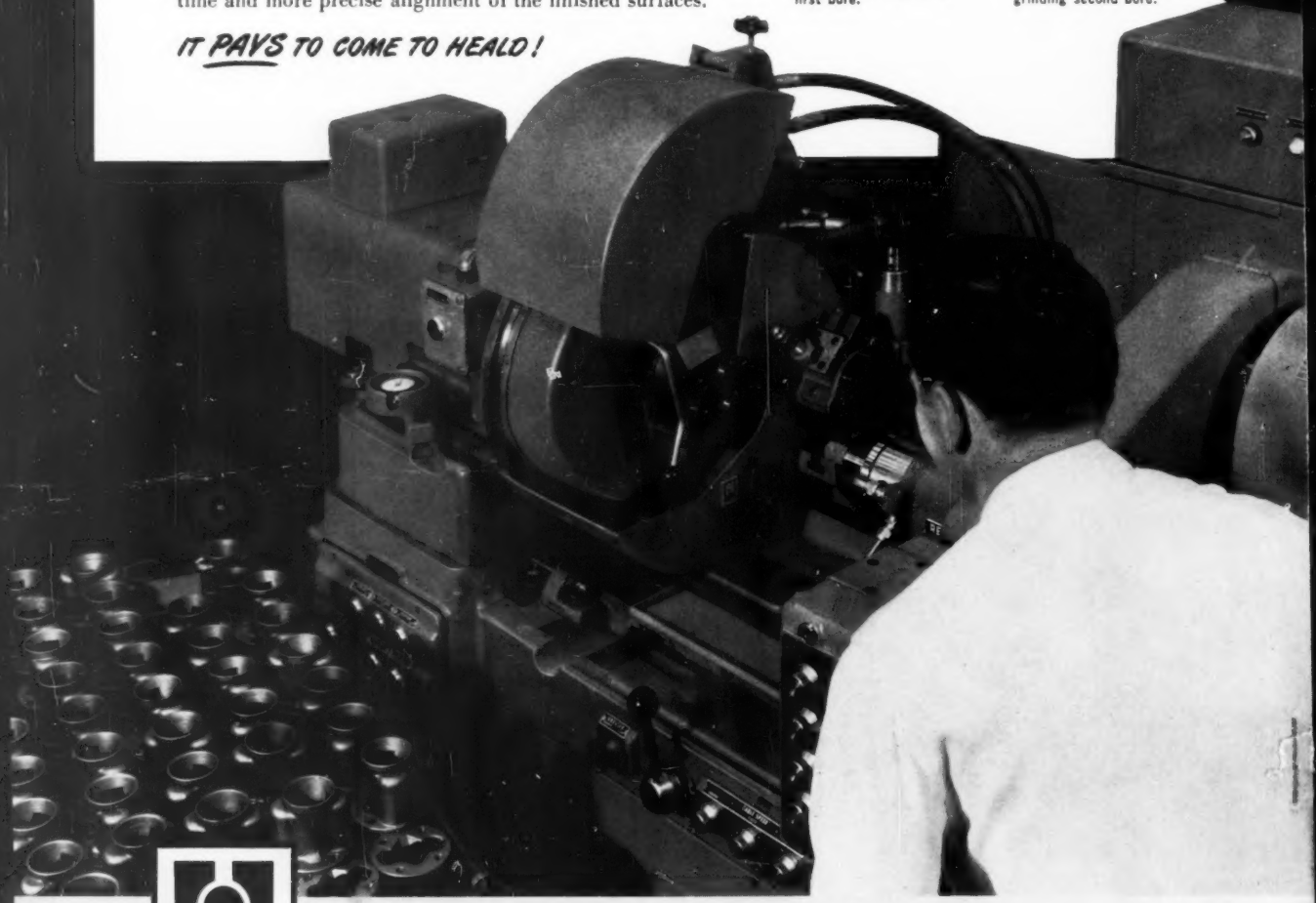
This auto-indexing feature can be used for many two-bore grinding jobs of this type with substantial savings in handling time and more precise alignment of the finished surfaces.



Auto-indexing fixture in position for grinding first bore.

Rotary cross-feed unit indexed to position for grinding second bore.

IT PAYS TO COME TO HEALD!



HEALD

THE **HEALD** MACHINE COMPANY

Worcester 6, Massachusetts

Subsidiary of The Cincinnati Milling Machine Co.

® Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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EPA NBP

Machinery

VOLUME 63 MARCH, 1957 NUMBER 7

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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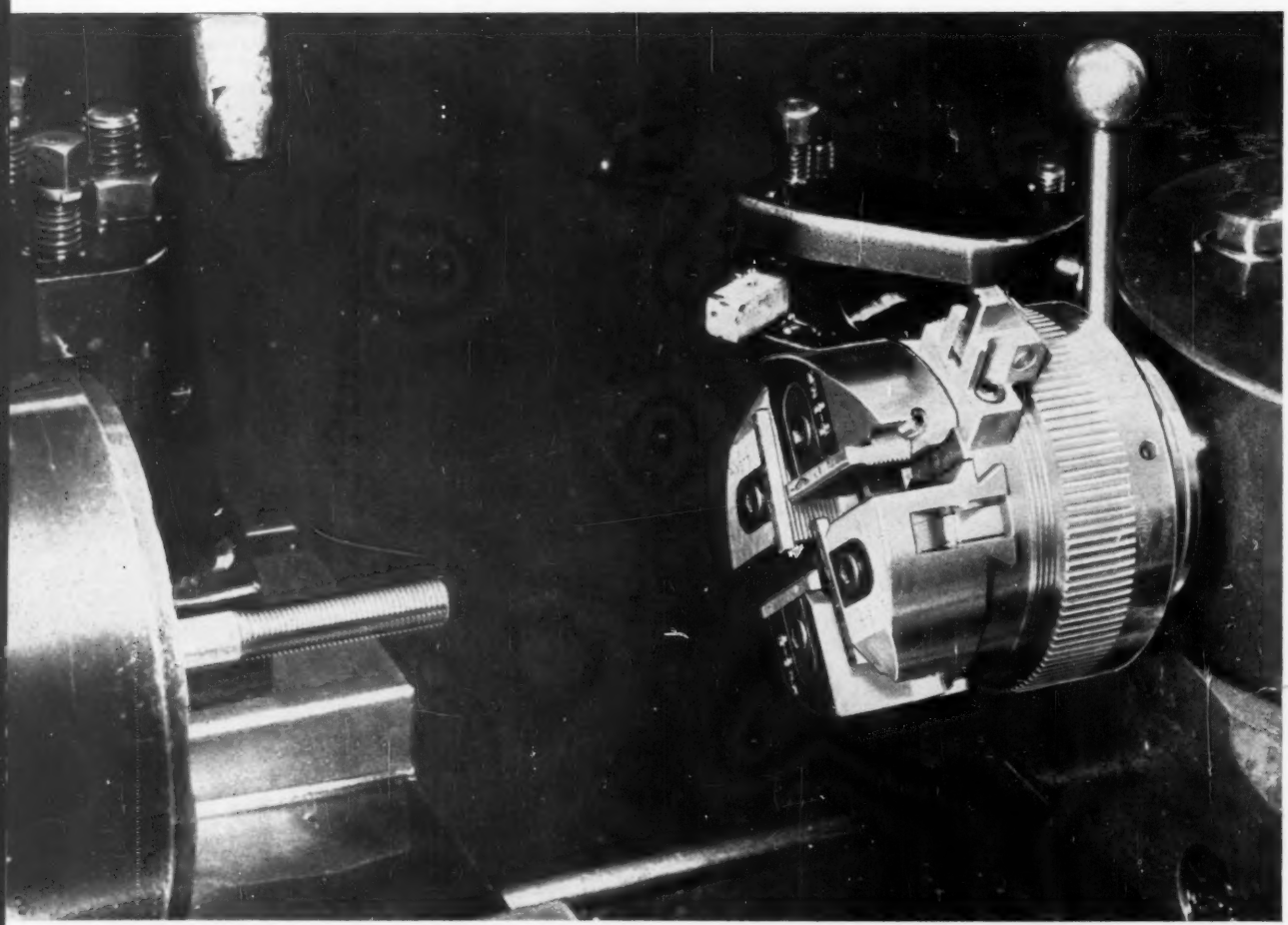


HELD TO .002"

between workpiece O.D. and thread with ***LANDIS*** *Die Head*

Centering Throat Chasers enabled the LANDMATIC Head to solve a difficult threading problem at the Minneapolis-Honeywell Regulator Co., Valve Division, in Philadelphia, Pa.

Threads on valve stems for diaphram control valves were required to meet a concentricity tolerance of .002" total indicator reading. The 5HH LANDMATIC Hardened and Ground Head using Centering Throat Chasers is the only head tested capable of producing these results.

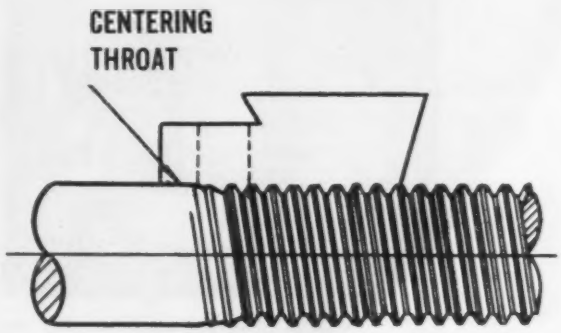
The Centering Throat Chasers used in this operation are specifically designed for producing threads requiring a high degree of concentricity with the outside diameter of the workpiece. Thus they are particularly adapted for cutting long thread lengths where there is a tendency of the workpiece to run out-of-round.

As indicated on the drawing, the centering throat section is allowed to protrude from the chaser cutting edge. This projection varies from $\frac{1}{8}$" for the coarse pitch threads to $\frac{1}{16}$" for the finer pitches. No cutting action takes place on this section of the chaser as it extends over the rotational centerline of the workpiece and only acts as a work aligning and supporting surface.

To produce these stems, $\frac{3}{8}$" 24-pitch UNF threads are cut $1\frac{5}{16}$" long on 316 stainless steel. Cutting at 30 SFM the 5HH LANDMATIC Head mounted on #2 B & S Hand-Operated Screw Machine, produces these threads to *Class 3 tolerances*. Entire lots of 400 pieces are run without regrinding the chasers.

The LANDMATIC Hardened and Ground Head is a stationary head, designed and built to give the great rigidity required for precision threading. It is available in a variety of sizes for producing threads from $\frac{3}{16}$" to 2" in diameter, and uses the LANDIS Tangential Chaser which may be reground and used for 80% of its original length.

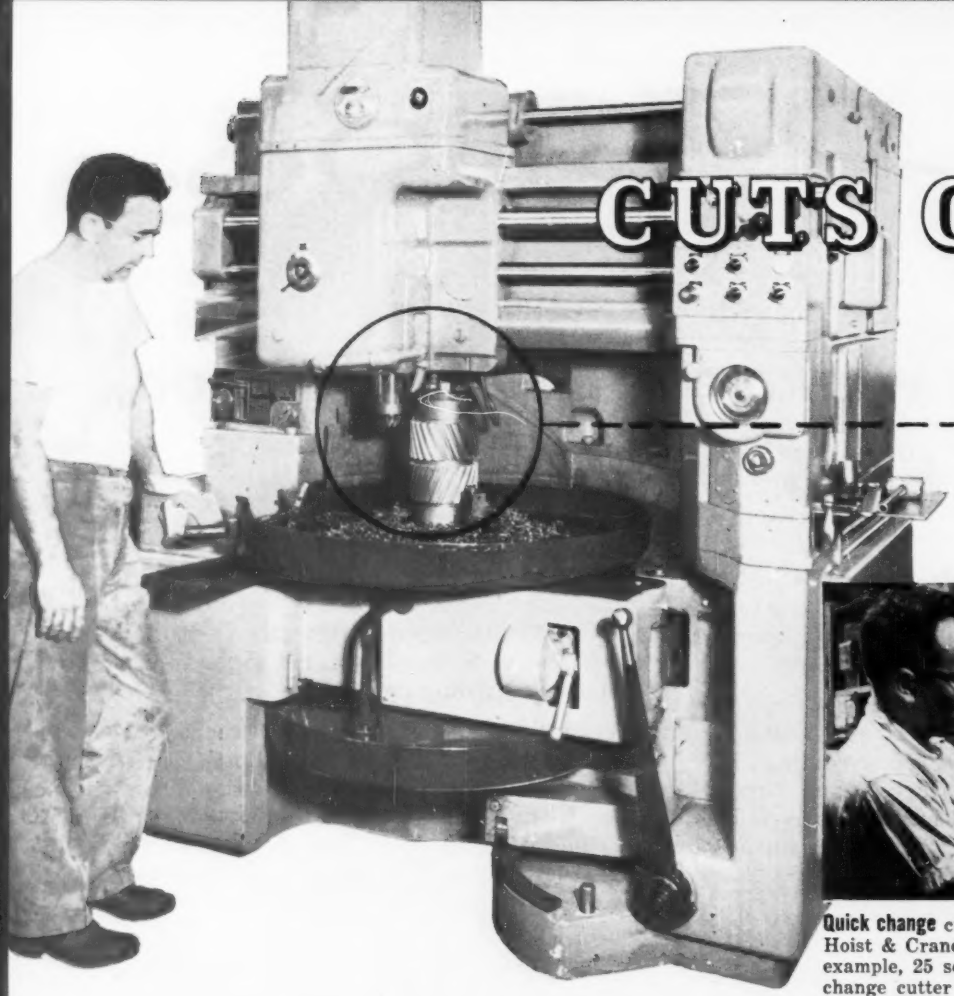
For detailed information, write for Bulletin F-80 — please include specifications.

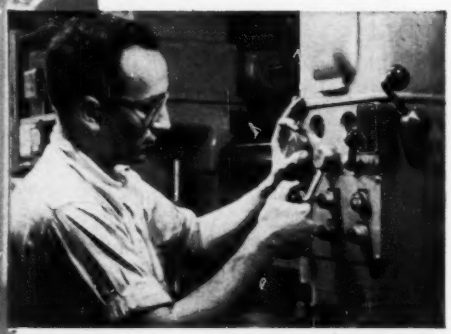


LANDIS *Machine* **COMPANY** | WAYNESBORO PENNSYLVANIA

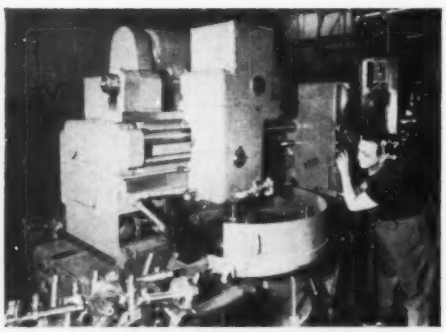
473C

CUTS COSTS

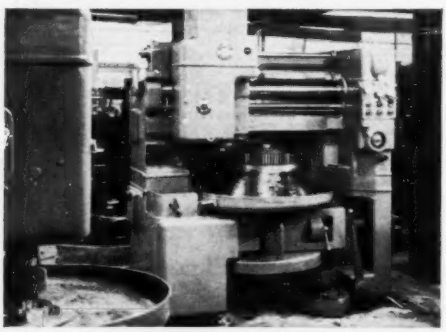




Quick change cuts costs on short runs: at Silent Hoist & Crane Company, Brooklyn, N. Y., for example, 25 seconds is all the time needed to change cutter speed, depth of cut and rotary feed for different sized sprockets.



Five times faster than the machines they replaced on a variety of jobs, 36-Type Gear Shapers set many cost-cutting records at New Process Gear Co., Syracuse, N. Y. Part shown cut in one operation. Rate: 135 finished per day.

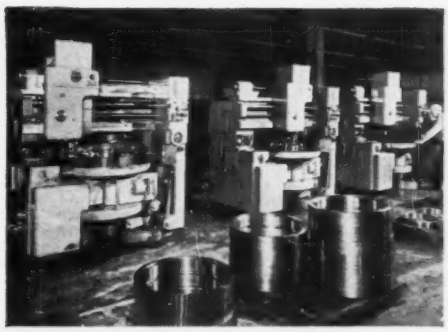


Faster on gears up to 36" P.D., two 36-Type machines replaced *five* older machines at Samuel M. Langston Co., Camden, N. J. 22.250" P.D., 4 D.P. steel spur shown is cut in 2½ hours. Production time on previous machine—10 hours.

THE PRECISION LINE

5 WAYS

FELLOWS
36-TYPE
GEAR SHAPER



Heavy cutting power: 36-Type Gear Shaper removes 93 cubic inches of stock (26 lbs.) from the blank in just two cuts to make this 25.3" P.D., 3 D.P. gear at Fairfield Manufacturing Co., Lafayette, Ind. Total time: 258 minutes.

More efficient small gear cutting, too: 57 minutes is all it takes to cut each hand of this 6.486" P.D., 5/7 D.P.; 23° H.A., herringbone pinion at Snow-Nabstedt Corporation, Hamden, Conn., on their 36-Type Gear Shapers.

Here's the way to lower gear production costs even though over-all costs keep rising! These major firms (and many others) have proved that fast, accurate Fellows 36-Type Gear Shapers have the power, speed and versatility to cut production costs . . . often by more than 50%!

Set-ups are fast and simple for a wide range of jobs up to 36" P.D. Cutter speeds from 18 to 300 strokes per minute are available through a selector dial. Four rotary feeds are available through a feed lever, additional feeds through two pick-off gears. Semi-automatic fixtures may be used to decrease loading time.

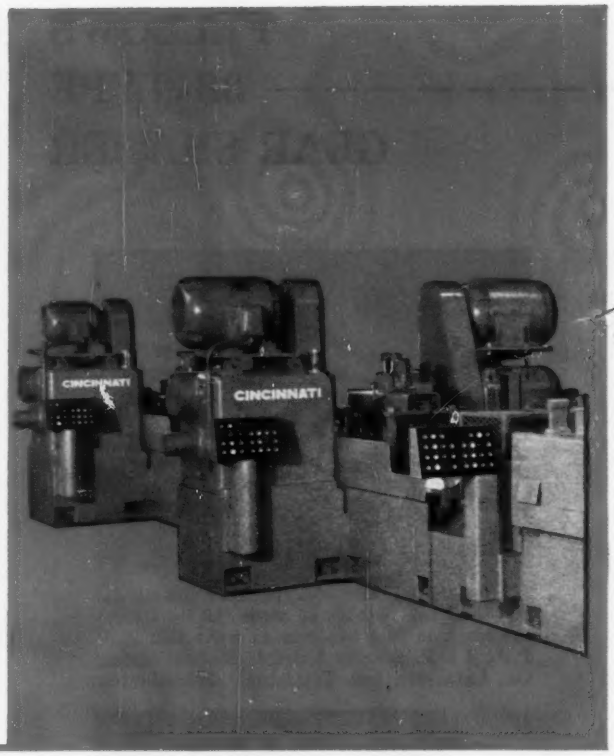
Whether for long runs or many varied jobs, the powerful, versatile Fellows 36-Type Gear Shaper can very probably lower *your* gear production costs. Your Fellows Representative can give you valuable facts and figures about the benefits of investing in the Fellows Precision Line of gear production equipment. Write, wire, or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 N. Woodward Ave., Royal Oak, Mich.
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

Fellows *Gear Production Equipment*

For more information fill in page number on Inquiry Card, on page 257

7 Operations
. . . by CINCINNATI 4-UNIT



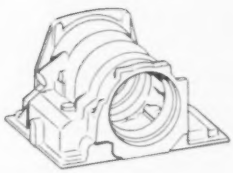
Today's transmission cases demand careful handling, low machining pressures, rapid production. These and other requirements are built into the CINCINNATI® 4-Unit Automatic Transfer Type Milling and Drilling Machine illustrated here. Seven machining operations and their related handling chores are performed automatically at the rate of 127 per hour, as the part progresses from right to left.

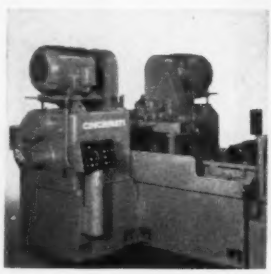
- **Unit 1** — Three operations: 1) rough, 2) semi-finish, 3) finish mill joint face
- **Unit 2** — Two operations: 1) drill, and 2) ream two manufacturing holes
- **Unit 3** — One operation: rough mill ends
- **Unit 4** — One operation: finish mill ends

Cincinnati engineered and built equipment of this type, and hundreds of other sizes, are busily at work in metal-working shops throughout the world. These cost-reducing machines are developments of Cincinnati Special Machine Tool Division. May we show you what this Division can do to reduce your costs? Give us complete details; a Cincinnati specialist will go to work on the job.

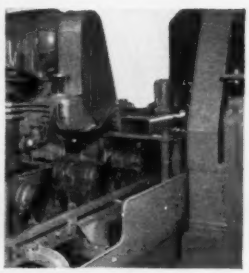
Special Machine Tool Division

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO





ENDS: a finish milling operation, following multiple drilling, gives the ends of the part a high-quality surface.

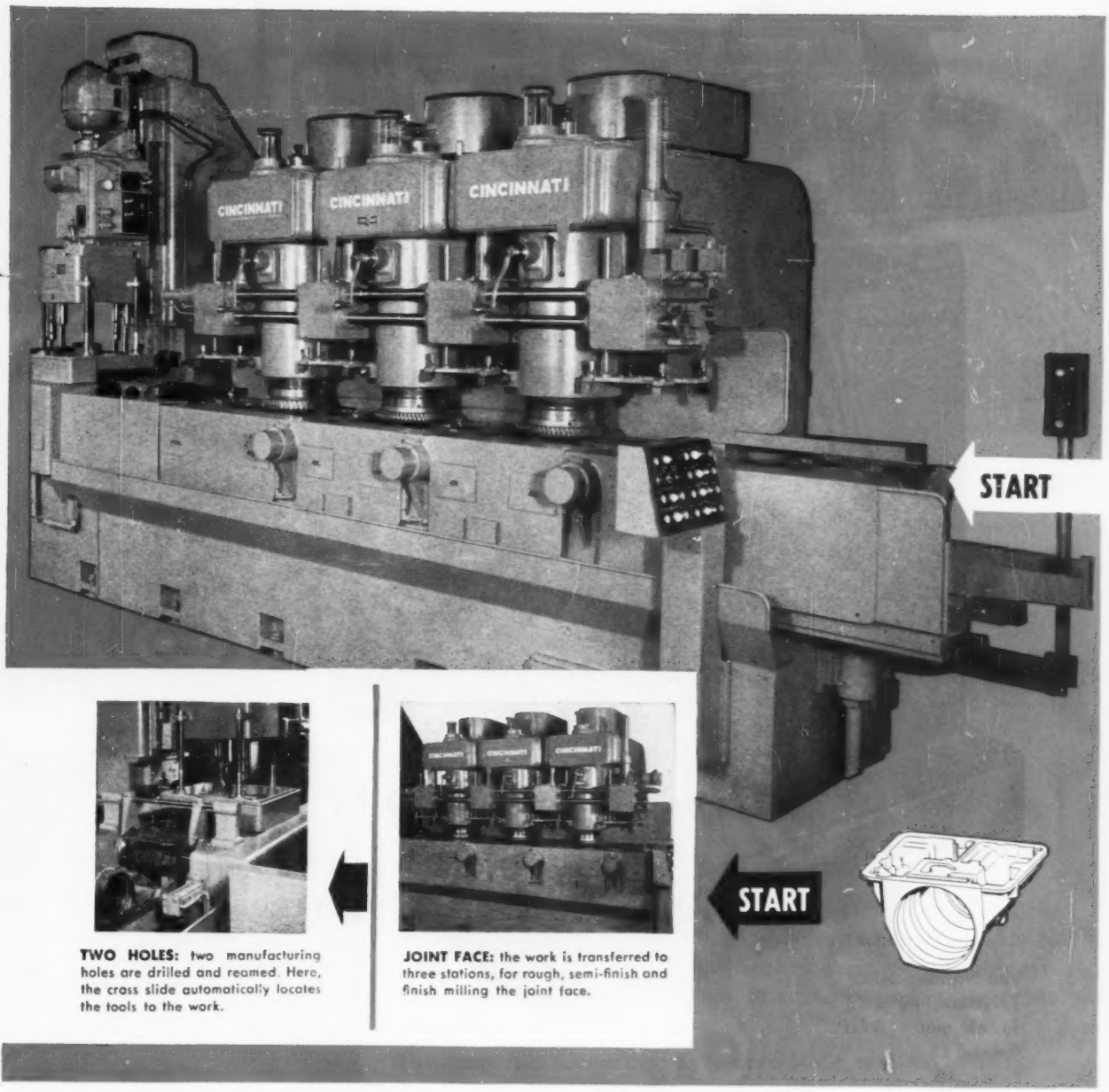


ENDS: before reaching this unit, the work has been turned over and located for a rough milling operation on the ends.

CINCINNATI

performed automatically

TRANSFER TYPE MACHINE



TWO HOLES: two manufacturing holes are drilled and reamed. Here, the cross slide automatically locates the tools to the work.

JOINT FACE: the work is transferred to three stations, for rough, semi-finish and finish milling the joint face.

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES
HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

For more information fill in page number on Inquiry Card, on page 257

WITH ONE

This adjustable cutterhead, standard equipment on the Van Norman 24MA, gives you two millers in one. It enables you to do horizontal, angular or vertical milling.

Van Norman 24MA
Table size: 50″ x 12″
Spindle motor: 5 HP
Speeds: 12
Feeds: 12

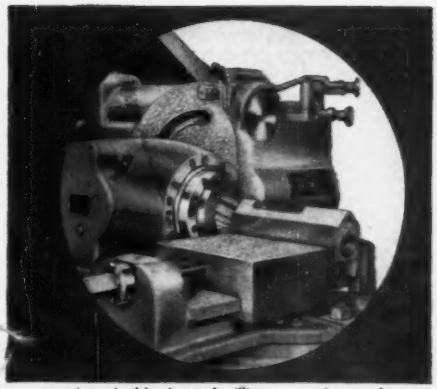
VAN NORMAN MACHINE

SUBSIDIARY OF VAN NORMAN INDUSTRIES, INC.

Manufacturers of — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

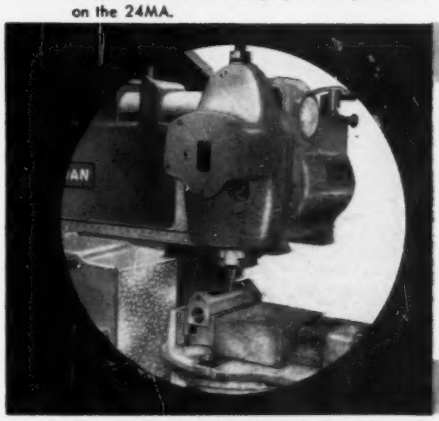
VAN NORMAN

RAM-TYPE MILLER YOU CAN DO...



A typical horizontal milling operation performed on the 24MA.

HORIZONTAL MILLING



The cutterhead, locked in vertical position, mills a slot in the workpiece.

VERTICAL MILLING

With cutterhead in angular position the same piece is milled without disturbing setup.

ANGULAR MILLING

WITHOUT ATTACHMENTS

One investment in *one* Van Norman ram-type miller gives you the equivalent of two conventional machines plus attachments. In addition to important savings on the investment, you also get big dollar savings through reduced work setups, idle machine and operator time and increased production.

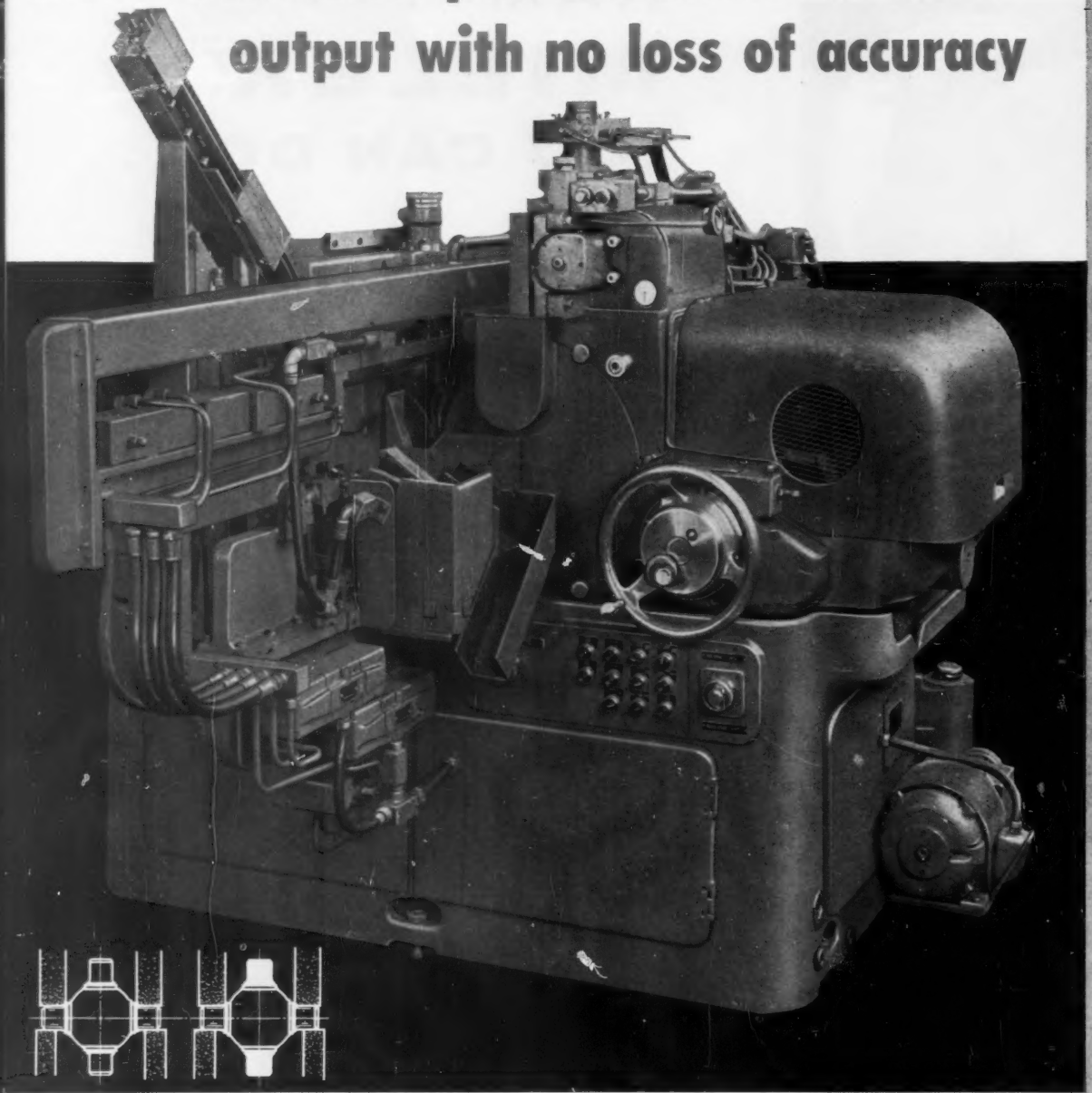
Get complete details on the Van Norman 24MA, or on any of the many Van Norman ram-type millers. Write, wire or telephone for catalog.

Don't wait . . . for extra profit install a Van Norman machine now! They are available on many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years.

COMPANY
SPRINGFIELD 7
MASSACHUSETTS

For more information fill in page number on Inquiry Card, on page 257

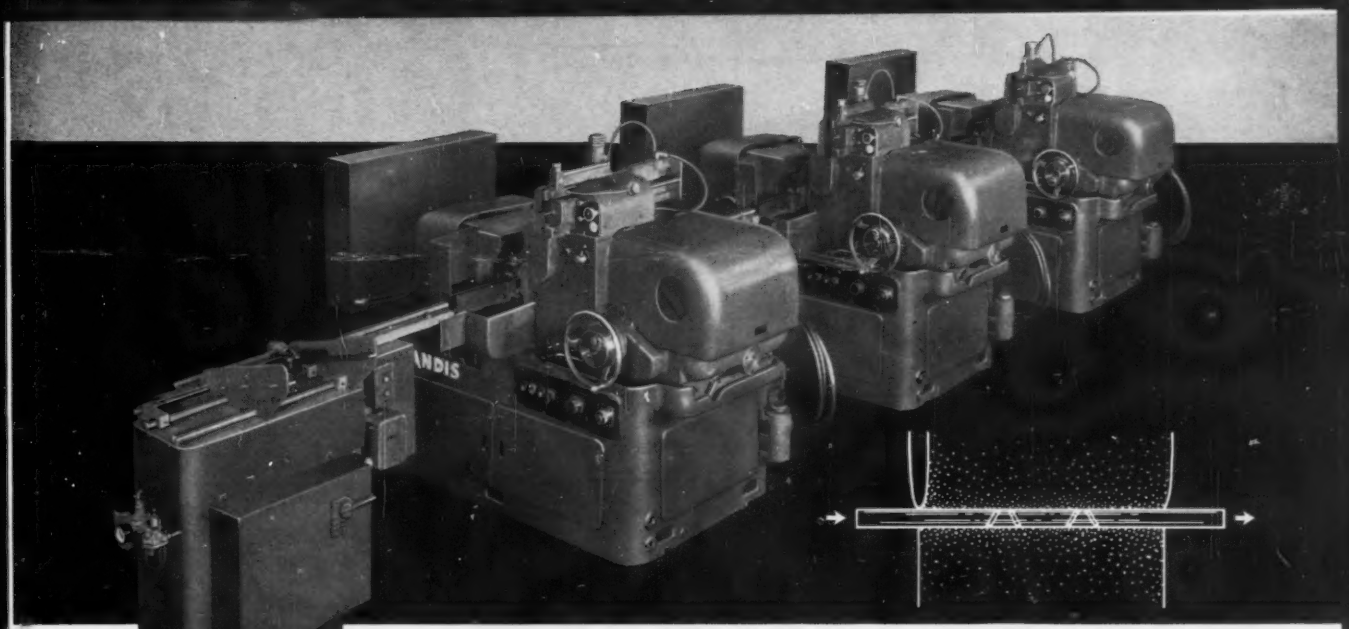
Landis ideas on automatic operation raise centerless production...increase output with no loss of accuracy



Automatic Grinding of Four Diameters and radii of universal joint spiders in one loading. Production is 250 per hour.

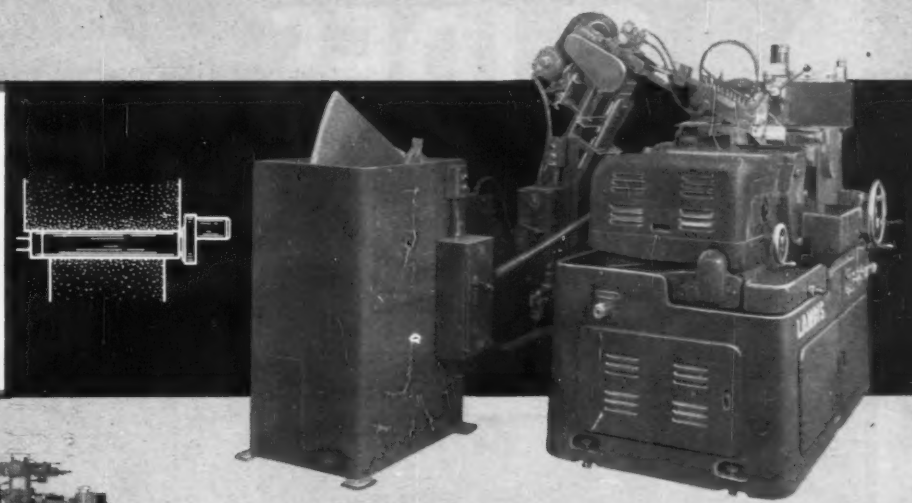
LANDIS

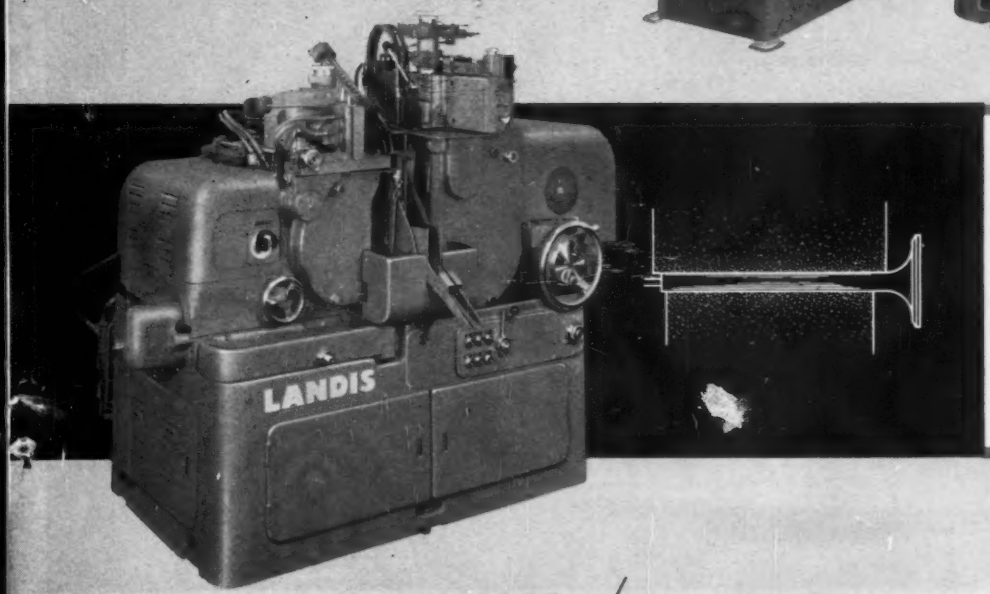
precision grinders



Automatic Grinders in Tandem for 3-operation grinding of motor shafts.

Automatic Grinding of Small Crankshaft. Production is 375 pieces per hour.

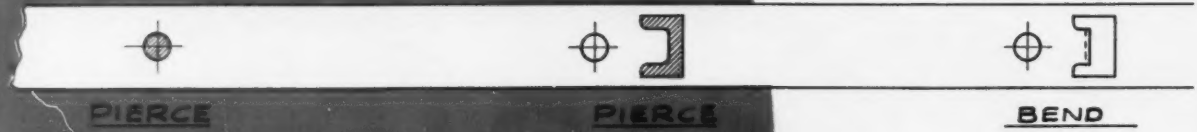




Automatic Finish Grinding of 1320 automotive valves per hour.

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

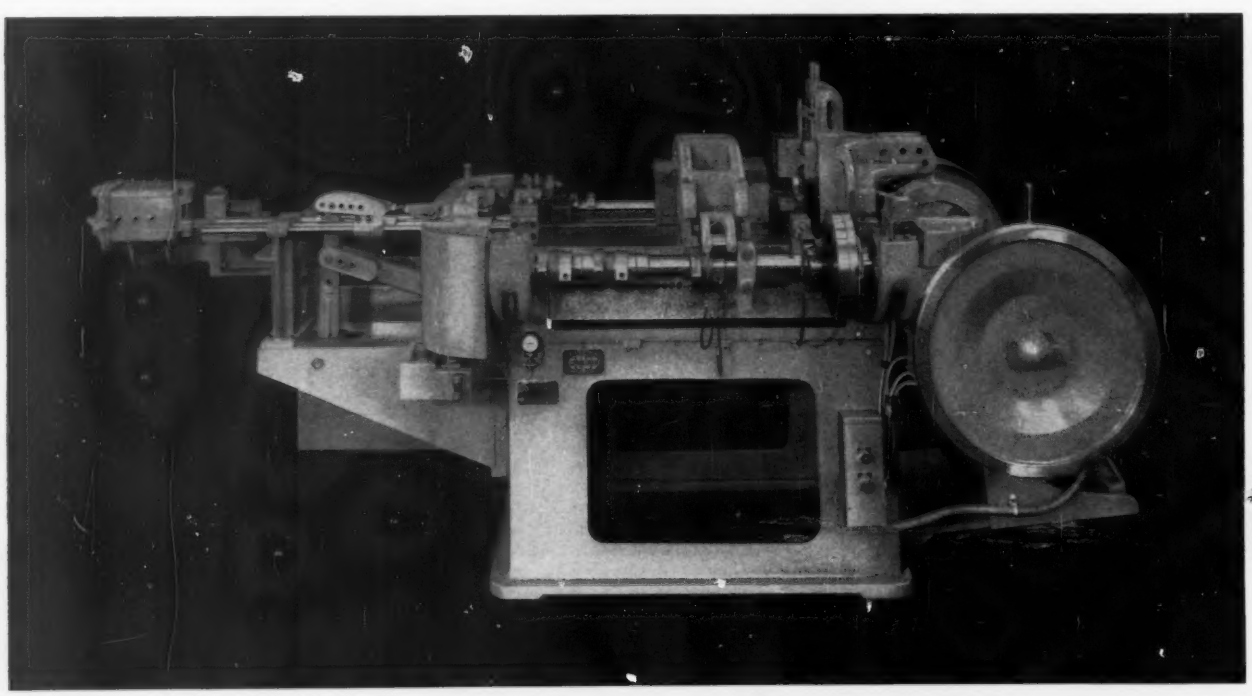
REDUCE COSTS ON FORMED STAMPINGS



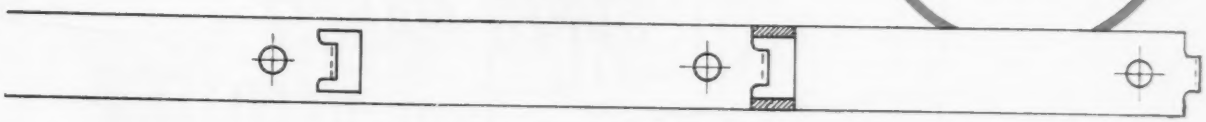
WITH

U. S. MULTI-SLIDES®

Below: The No. 33 U. S. Multi-Slide used with appropriate tooling to produce the formed metal stamping illustrated on the opposite page. The No. 33 Multi-Slide has a capacity for material up to 2½" wide, with feed length adjustable up to 12½".



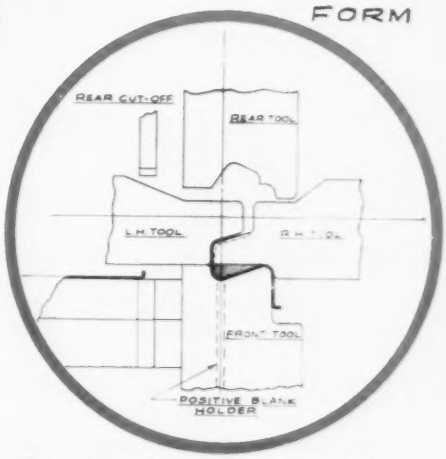
Formed metal stamping produced complete on the U. S. Multi-Slide. Drawings below indicate the progressive operations in the dies and forming position.



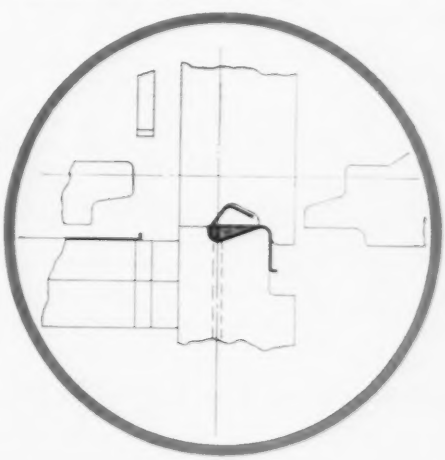
If you produce formed metal stampings, the U. S. Multi-Slide may be the answer to your cost reduction problems. The part illustrated is just one of the many different types of stampings that can be produced complete on the U. S. Multi-Slide—without secondary handlings. The combination of ram action, four-slide forming, vertical stripper, and various auxiliary units allows for the designing of tools to produce intricate parts complete—without the need for secondary operations . . . and every such operation that can be eliminated increases your profit potential.

Since these movements are an integral part of the machine equipment, it is not necessary to build complicated movements into the dies themselves, thereby giving the added advantage of reduced tool maintenance cost.

Investigate! Ask for a copy of Bulletin 15-A, or send us samples or drawings of your parts for our recommendations.



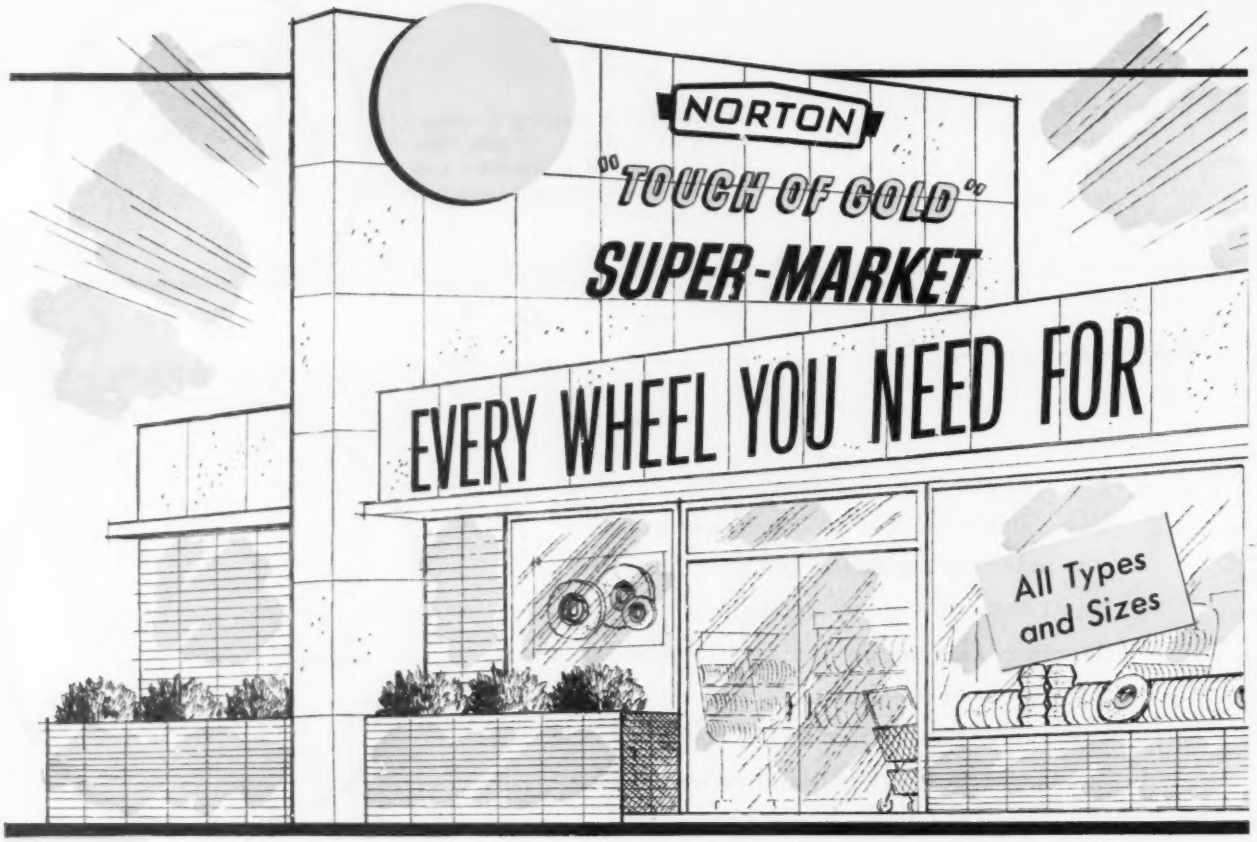
Operations in the forming position: Above: front, right-hand and left-hand tools entered to preform part around post. Below: right-hand and left-hand tools retracted; front and rear tools entered to complete the form.



U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers — U. S. Die Sets and Accessories — U. S. Automatic Press Room Equipment



Let's toss a bouquet to the modern super-market — one of the greatest time and trouble savers in present-day living.

But, have you ever stopped to think that, in the abrasives field, Norton brings you real super-market convenience? Here, in the world's largest line of abrasive products, is everything you need for every grinding job.

Take tool room grinding wheels. In these, as in all other categories, the Norton line is 100% complete. You don't have to shop around — going to one source for wheels that will sharpen steel tools, to another for diamond wheels, to another for mounted wheels.

You can get them all at Norton. And they're all the best wheels that can possibly be made. The advanced equipment and broad experience you find at Norton you'll find nowhere else in abrasives manufacture.

Advantages like these mean leadership. And they result in precision-processed, precision-performing wheels that grind exactly alike — from wheel to wheel and lot to lot.

See Your Norton Distributor for wheels that will bring the value-adding, profit-boosting "Touch of Gold" to all your tool room grinding operations. Ask him for the two helpful booklets — *A Handbook on Tool Room Grinding* and a booklet on *How To Select Wheels For Precision Grinding Tool And Constructional Steels.* Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y., a division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated. **For the booklets or other information write to Norton Company, Worcester 6, Mass.**

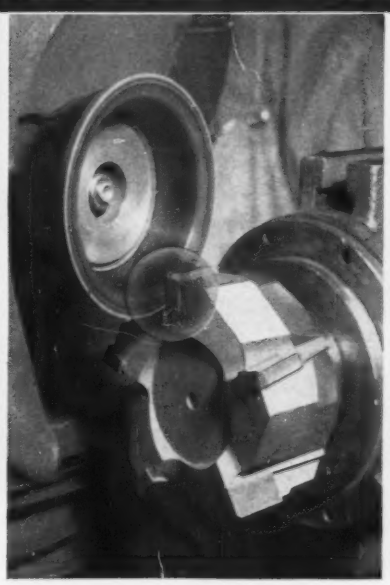
TOOL ROOM GRINDING

Precision-Processed

All abrasives and bonds

Precise Duplication

FOR SHARPENING STEEL TOOLS, as well as for surface, cylindrical and internal grinding on all steels, Norton G Bond and BE Bond Wheels — in 32 ALUNDUM*, 38 ALUNDUM, 19 ALUNDUM or the new non-premium priced 44 ALUNDUM abrasive — add the money-saving, cost-cutting "Touch of Gold." These vitrified bonds are the most efficient ever developed for precision and semi-precision grinding.



FOR CARBIDE GRINDING, Norton diamond wheels are the recognized "Crown Jewels." Made in the regular B resinoid bond for wet grinding and the B6 resinoid bond for dry grinding. For many carbide grinding jobs Norton K Bond CRYSTOLON* wheels are often the best investment.

FOR DIE AND MOLD FINISHING Norton mounted wheels bring you big savings on the widest range of tool room jobs. They're a 100% complete line, for all requirements.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

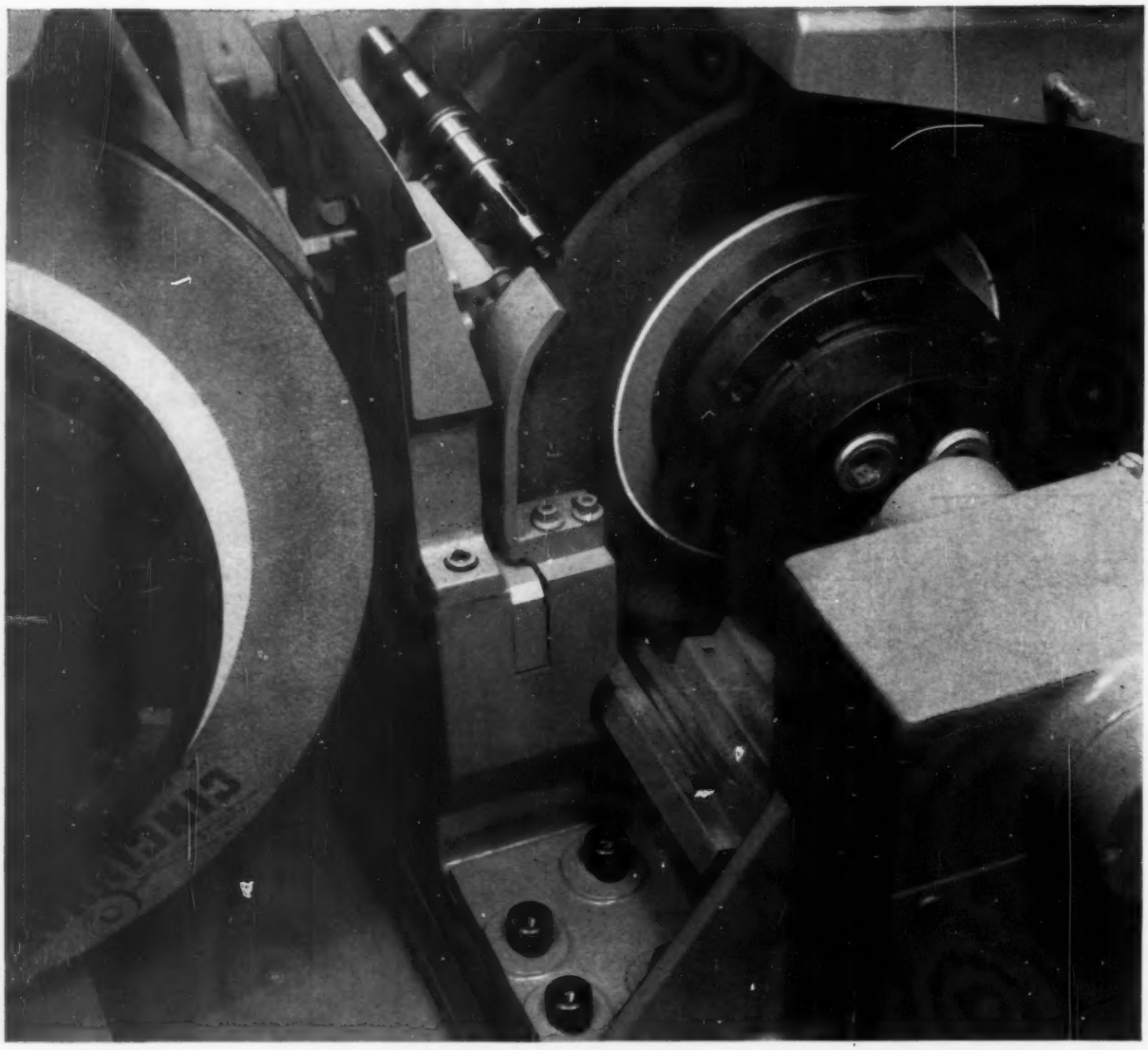
Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

W-1763

For more information fill in page number on Inquiry Card, on page 257

Cincinnati Filmatic



Refrigerator crankshafts are safely and economically ground at an estimated production of 100 per hour on the CINCINNATI FILMATIC No. 2 Centerless production package illustrated above. Equipment includes an Electro-Hydraulic Automatic Infeed Attachment and a mechanically operated elevating fixture of the "wrap-around" type. The work loading cradle is pivoted on the same center as the regulating wheel spindle, and as it elevates to loading position, it follows the diameter of the regulating wheel. This construction assures a maximum factor of safety in loading and removing the work. CINCINNATI FILMATIC Centerless Grinders are "naturals" for work of this type.

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Nos. 0 2 3 4 5 6 Centerless

The No. 2 is the machine for this job . . . grinding four diameters of household refrigerator crankshafts

FILMATIC

Multiple diameter jobs are "naturals" for CINCINNATI® FILMATIC Centerless Grinders . . . and for Cincinnati's 32 years' experience in centerless tooling. The illustration at the left shows how these two major elements of production—the right machine and the proper tooling—have been combined to reduce the cost of grinding four diameters on crankshafts for a well-known refrigerator. ¶ A new CINCINNATI FILMATIC No. 2 was selected for the job. All four diameters are centerless ground simultaneously; to close limits of accuracy; exactly in line with each other.

The operator merely pushes a button, and the entire grinding cycle proceeds automatically.

Much of the outstanding success of centerless grinding this part can be attributed to the machine. FILMATIC grinding wheel spindle bearings cannot deflect under wide infeed cuts; bed-rock design for grinding wheel spindle housing withstands maximum hp metal removal; swivel mounting of regulating wheel pile simplifies setups; anti-friction infeed slide reduces maintenance and helps to maintain close tolerances. Would you like to know more about the latest CINCINNATI FILMATIC No. 2 Centerless? Or perhaps the entire line? Look in Sweet's Machine Tool File.

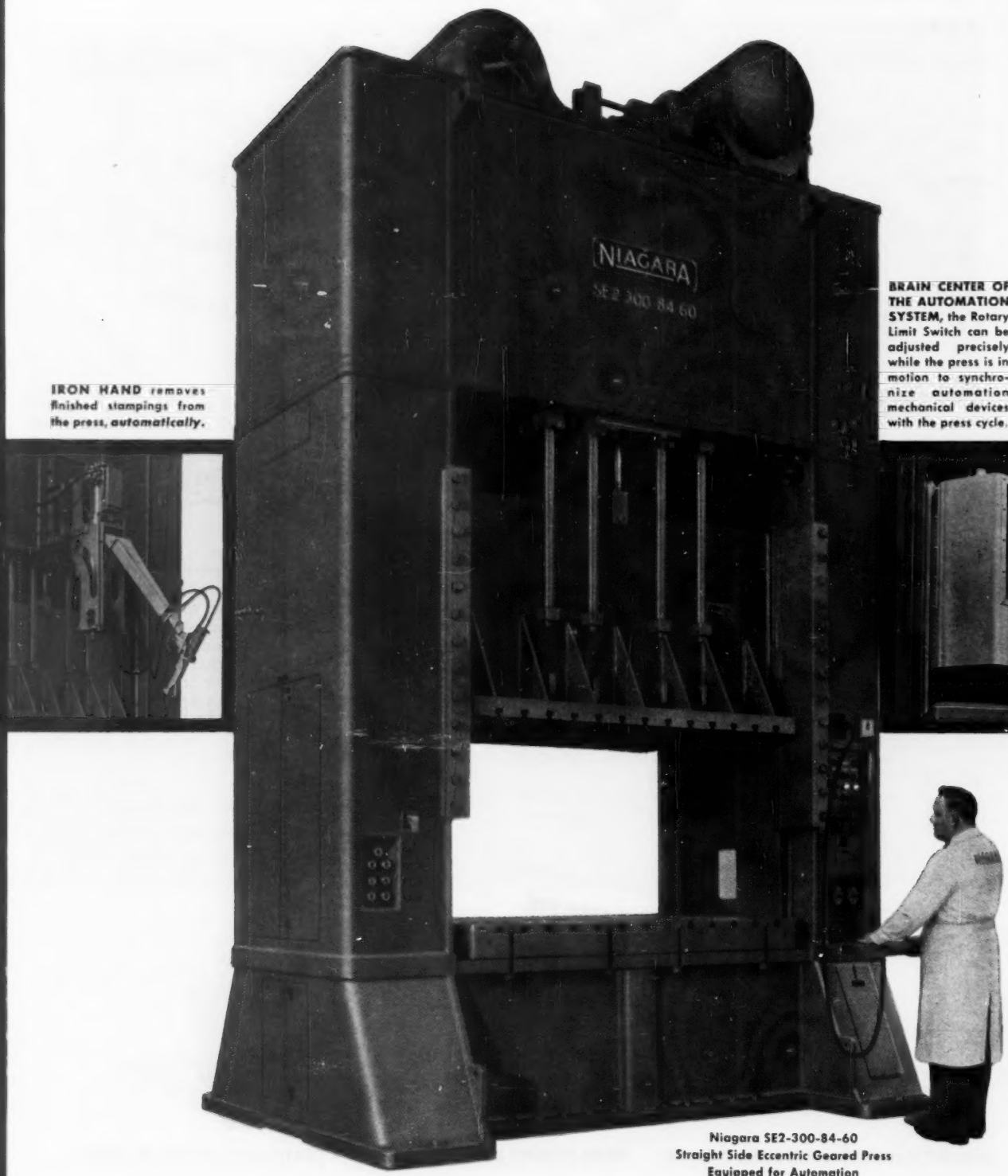
CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI FILMATIC
No. 2 CENTERLESS
GRINDING MACHINE
CATALOG No. G-644-2

GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

For more information fill in page number on Inquiry Card, on page 257

see how mighty Niagara Presses



IRON HAND removes finished stampings from the press, *automatically*.

BRAIN CENTER OF THE AUTOMATION SYSTEM, the Rotary Limit Switch can be adjusted precisely while the press is in motion to synchronize automation mechanical devices with the press cycle.

Niagara SE2-300-84-60
Straight Side Eccentric Geared Press
Equipped for Automation

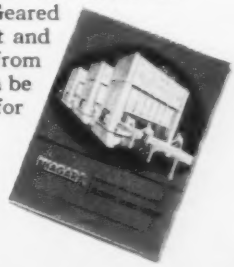
are automated for peak productivity

Engineered to excel in large, heavy tonnage drawing, punching and blanking work, Niagara Straight Side Eccentric Geared Presses are readily outfitted with the most advanced automation controls and devices. Net result: Streamlined production, greater safety and simplified operation.

Take a look at the modern, enclosed construction of this rugged Niagara Two-Point Eccentric Geared Press. See how today's most advanced automation controls and devices are furnished as integral, built-in components of the press itself . . . *with piping and wiring fully concealed.* Note, too, how the driving assembly is neatly housed within the crown. Nothing has been overlooked in making this press an outstanding engineering triumph.

Niagara's eccentric drive delivers greater torque with less deflection. Rigid, all-steel, four-piece, tie rod frame provides utmost accuracy and prolonged die life. Niagara's low inertia, pneumatic friction clutch runs cooler and outlives others, for most of its weight continues to rotate with the flywheel to reduce heat and wear.

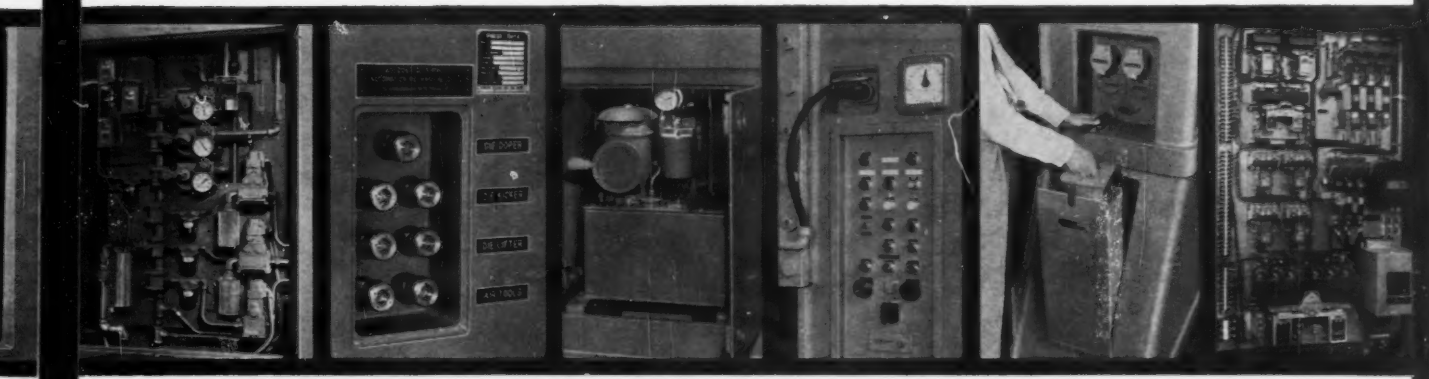
MAKE SURE THAT YOU HAVE ALL OF THE FACTS on Niagara Straight Side Eccentric Geared Presses . . . the one point, two point and four point designs in capacities from 100 - 1000 tons . . . and how they can be equipped for automation. Write for illustrated Bulletin 66 today.



NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U. S. cities and major foreign countries



AIR CONTROL PANEL (Above left) conceals and protects air line pressure switches, lubricators, filters, gauges and valves behind dust-tight doors within one of the uprights.

CONTROLLED AIR SUPPLY RECEPTACLES (Above right) are provided for die doper, die kicker and die lifter, all synchronized with press cycle. Auxiliary receptacles are for die maintenance tools.

AUTOMATIC CIRCULATING OIL SYSTEM (Above left) sends metered flow of clean, filtered oil to all bearings and gears in the crown, as well as to slide gibs. Correct operating oil pressure is maintained or press stops automatically.

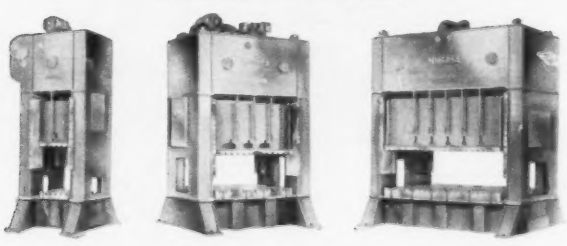
OPERATOR'S PANEL (Above right) features de-luxe operating controls conveniently arranged for fingertip direction of every press motion. Note receptacle for "RUN" push button station and Selsyn stroke position indicator.

AUX. POWER SUPPLY & SAFETY BLOCK. (Above left) Two 110 V. and two 440 V. receptacles for automation equipment, conveyors, tools, etc. Safety block (stored in bin) is chained to safety plug which de-energizes press control when pulled from receptacle.

COMB. MOTOR & PRESS CONTROL (Above right) in oil and dust-tight enclosure flush mounted in frame.

ONE-POINT, TWO-POINT AND FOUR-POINT SUSPENSION

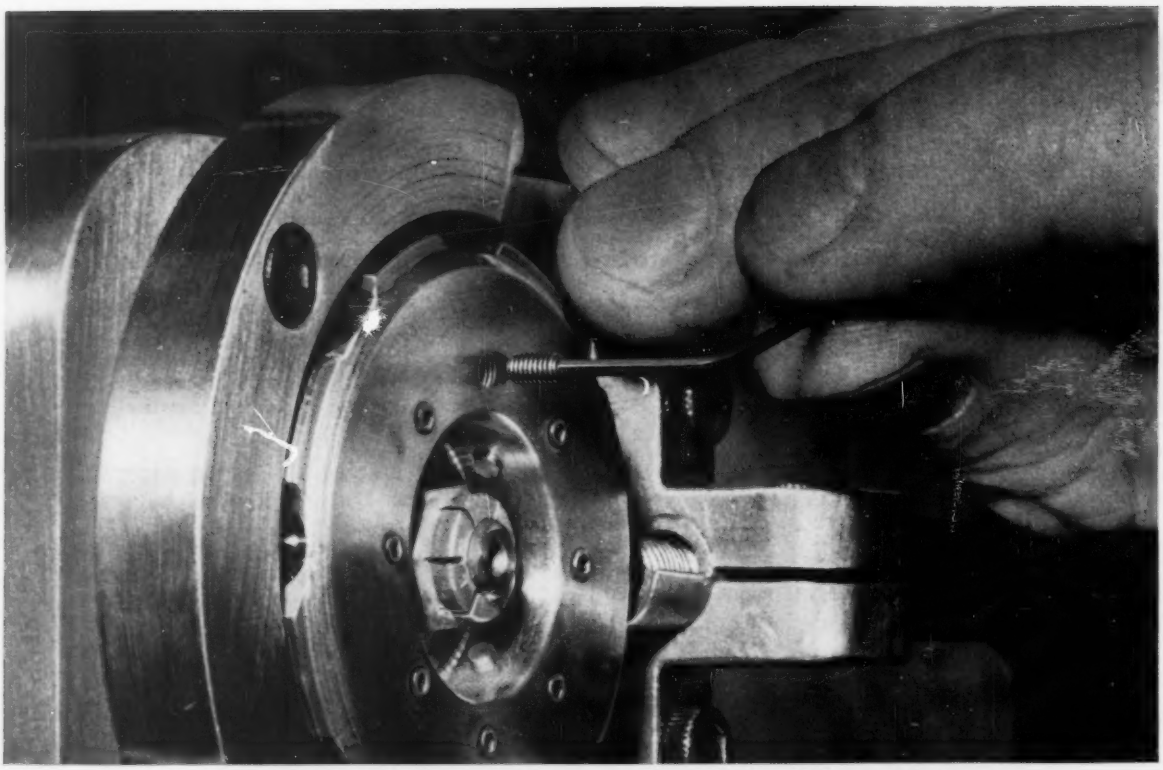
(100 through 1000 ton capacities)



NIAGARA

straight side ECCENTRIC GEARED presses

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.



Microsize UNBRAKO socket screws simplify design problems—even in highly specialized equipment like this prototype precision loading device for use in advanced automated production operations.

Miniaturize with UNBRAKO set screws

HEAT-TREATED ALLOY STEEL*
PLAIN CUP POINT
Class 3 Fit Standard

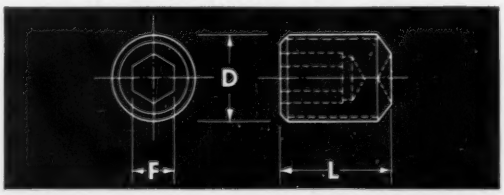
Diameter		Threads per inch NC	Threads per inch NF	L Overall Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per Box of 100 in Pounds
#0	D .060 F .028	..	80	1/16	..	.5	.01
		..	80	3/32	..	.5	.01
		..	80	1/8	..	.5	.01
		..	80	5/32	..	.5	.01
		..	80	3/16	..	.5	.01
		..	80	1/4	..	.5	.01
#1	D .073 F .035	..	72	1/16	..	1.5	.02
		..	72	3/32	..	1.5	.02
		..	72	1/8	..	1.5	.02
		..	72	5/32	..	1.5	.02
		..	72	3/16	..	1.5	.02
		..	72	1/4	..	1.5	.02
#2	D .086 F .035	56	..	1/16	1.5	..	.03
		56	..	3/32	1.5	..	.03
		56	..	1/8	1.5	..	.03
		56	..	5/32	1.5	..	.03
		56	..	3/16	1.5	..	.03
		56	..	1/4	1.5	..	.03
#3	D .099 F .050	48	..	3/32	5.0	..	.04
		48	..	1/8	5.0	..	.04
		48	..	5/32	5.0	..	.04
		48	..	3/16	5.0	..	.04
		48	..	1/4	5.0	..	.04

*Also available in stainless steel

You need not design special set screws to secure your new miniaturized equipment. Microsize UNBRAKOS were developed specifically for use in modern small devices.

UNBRAKO screws are made of carefully selected alloy steel. They are manufactured to timepiece precision. Sockets are deep and uniform for greatest wrench engagement and longest reuse. Threads are fully formed for maximum strength and exact fit. And UNBRAKOS are heat treated to the optimum condition for high tensile strength and ductility without brittleness or decarburization.

Ask your authorized industrial distributor about microsize UNBRAKO socket screws today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.



STANDARD PRESSED STEEL CO.
UNBRAKO SOCKET SCREW DIVISION SPS
JENKINTOWN PENNSYLVANIA

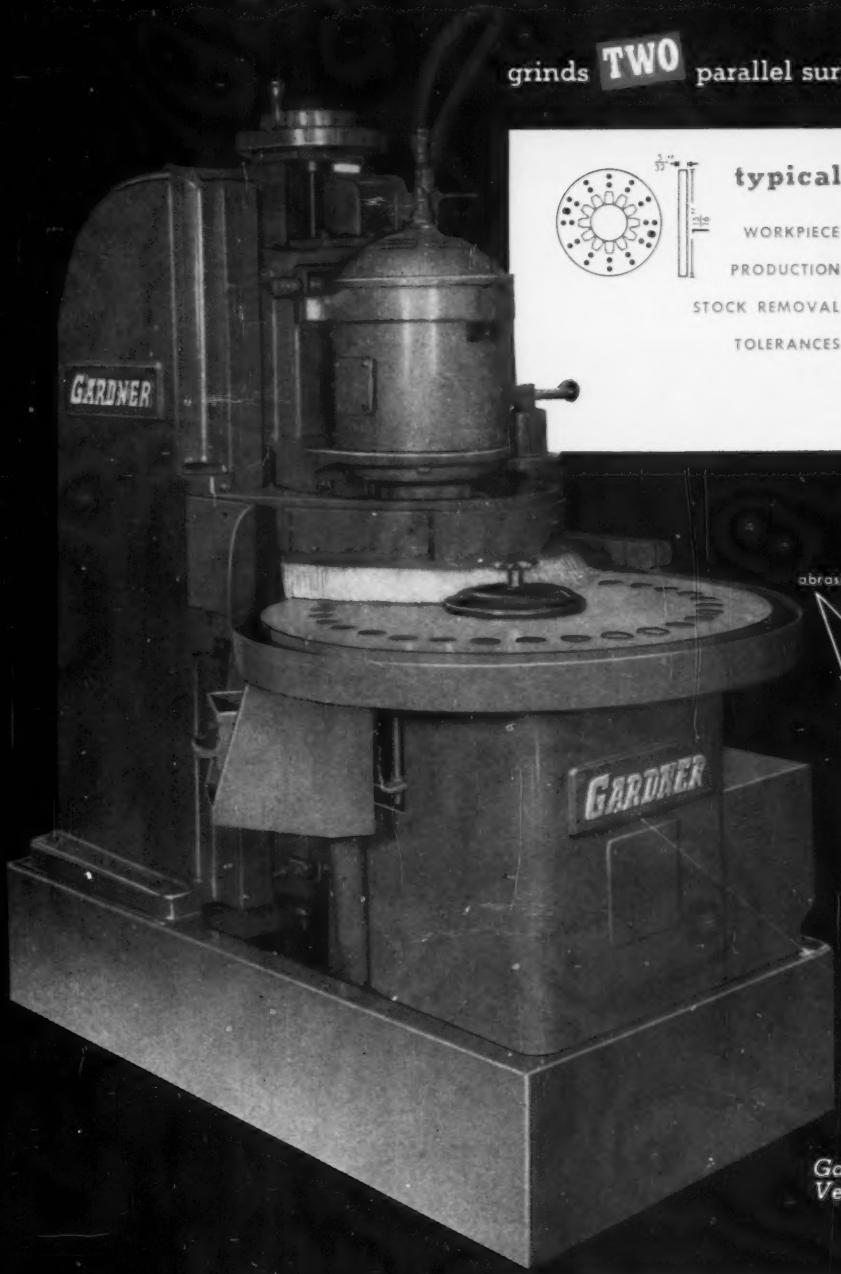
For more information fill in page number on Inquiry Card, on page 257

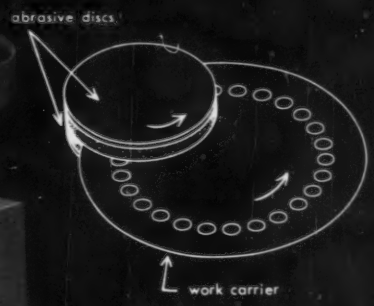
Improved Gardner vertical double disc grinder ...for high production, low cost flat surfacing

grinds **TWO** parallel surfaces in **ONE** operation

typical operation

WORKPIECE	Ceramic switch stators
PRODUCTION	1200 per hour
STOCK REMOVAL	.010" to .016"
TOLERANCES	.002" flatness .002" parallelism .004" uniformity





Gardner 2V18
Vertical Spindle Disc Grinder

GARDNER

precision disc grinders

BELOIT, WISCONSIN

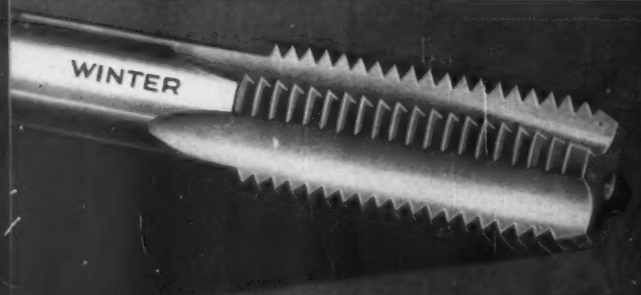
UNIFORMITY OF FLUTE CONTOURS is one of the four essentials in Balanced Action performance—exclusive with Winter Taps.

Designed and built for men who know tapping costs:

BALANCED ACTION TAPS BY WINTER

The Winter Tap user has learned to consider only one cost: the *cost-per-hole*, shown by his records of accurate holes and long life.

CALL YOUR WINTER DISTRIBUTOR

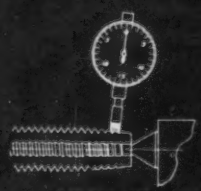


EXACT FLUTE SPACING

WINTER

WINTER BROTHERS COMPANY
Rochester, Michigan, U.S.A.
Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.

PRECISION CHIP DRIVE CONTOURS



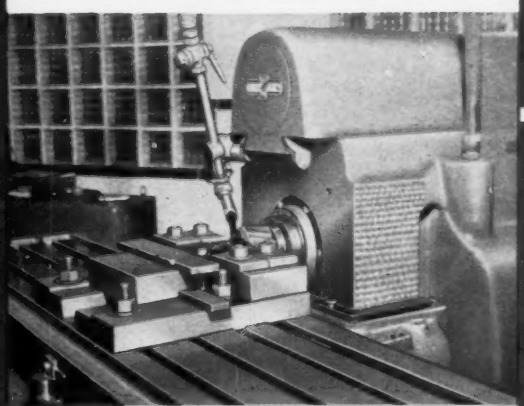
ACCURATE AND CONCENTRIC CHAMFERS

NATIONAL TWIST DRILL & TOOL
ROCHESTER, MICH., U.S.A.

Lowering the cost of metal cutting through laboratory research...

is a continuing process at National's Rochester plant. Many of the findings are already evident in the improved National tools of today; more can be expected in National's tools of tomorrow.

CALL YOUR
NATIONAL DISTRIBUTOR



The search that never ends for better cutting methods... test milling of high tensile strength steel.

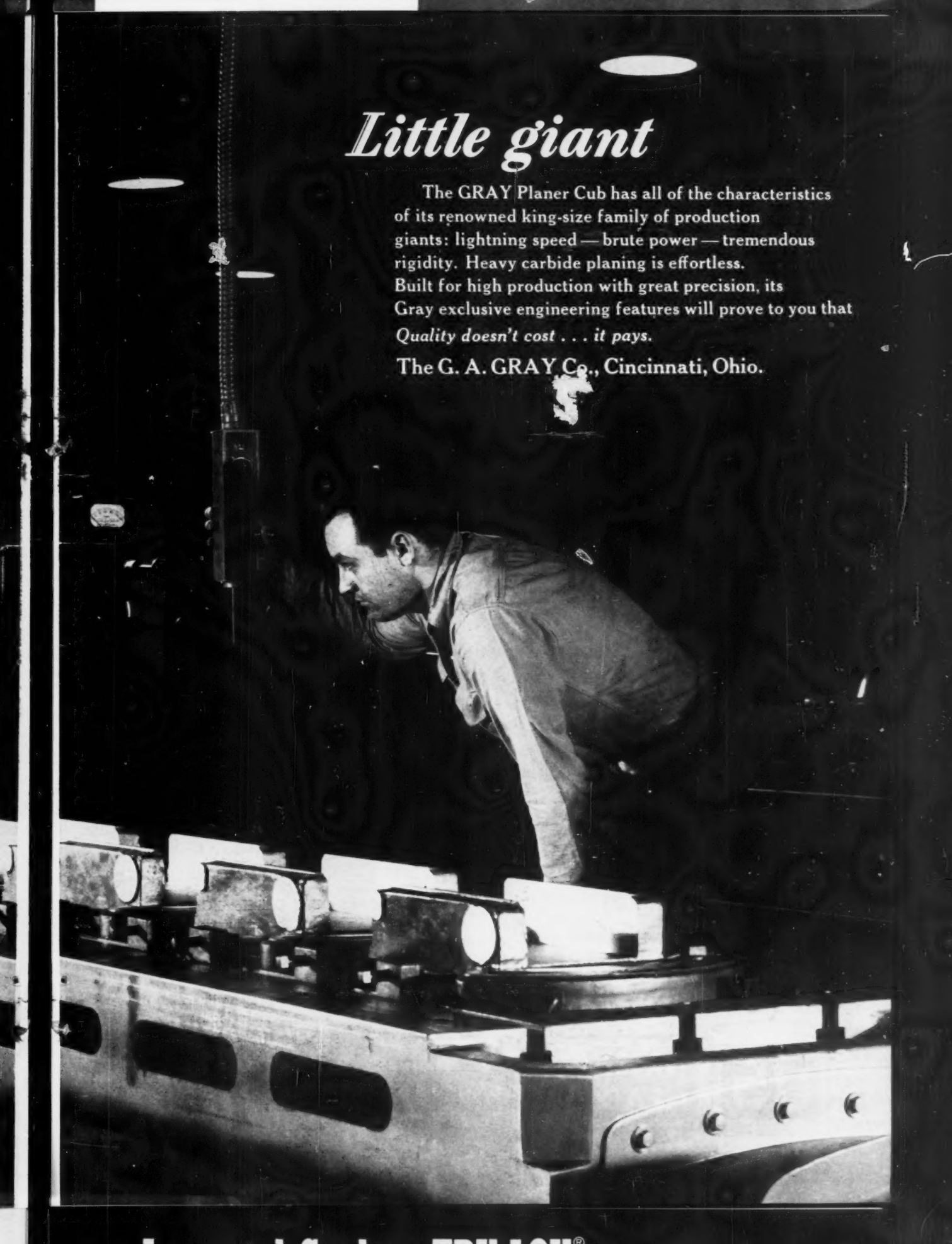
National

NATIONAL TWIST DRILL AND TOOL COMPANY

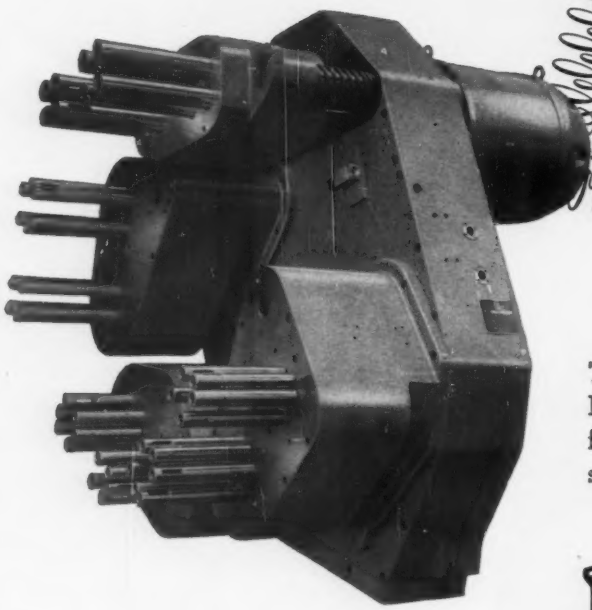
Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

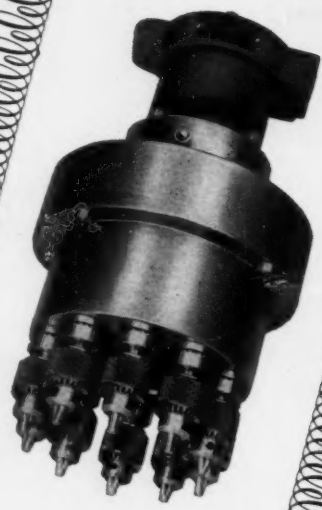
TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • CARBIDE AND SPECIAL TOOLS

GRAY


Little giant
The GRAY Planer Cub has all of the characteristics of its renowned king-size family of production giants: lightning speed — brute power — tremendous rigidity. Heavy carbide planing is effortless. Built for high production with great precision, its Gray exclusive engineering features will prove to you that
Quality doesn't cost . . . it pays.
The G. A. GRAY Co., Cincinnati, Ohio.

FROM THEN...
...TO ETERNITY





1924

The U. S. Drill Head Company's first Fixed Center Drill Head was produced for Borg and Beck, of Chicago — a subsidiary of Borg-Warner.

1957

The 50,000th Head was shipped.

For men who know drill heads best, it's always U. S. Drill Head ...5 to 1

Since 1915, when the U. S. Drill Head Co. built its first adjustable head, it has far surpassed all other similar manufacturers because of its engineering and production facilities.

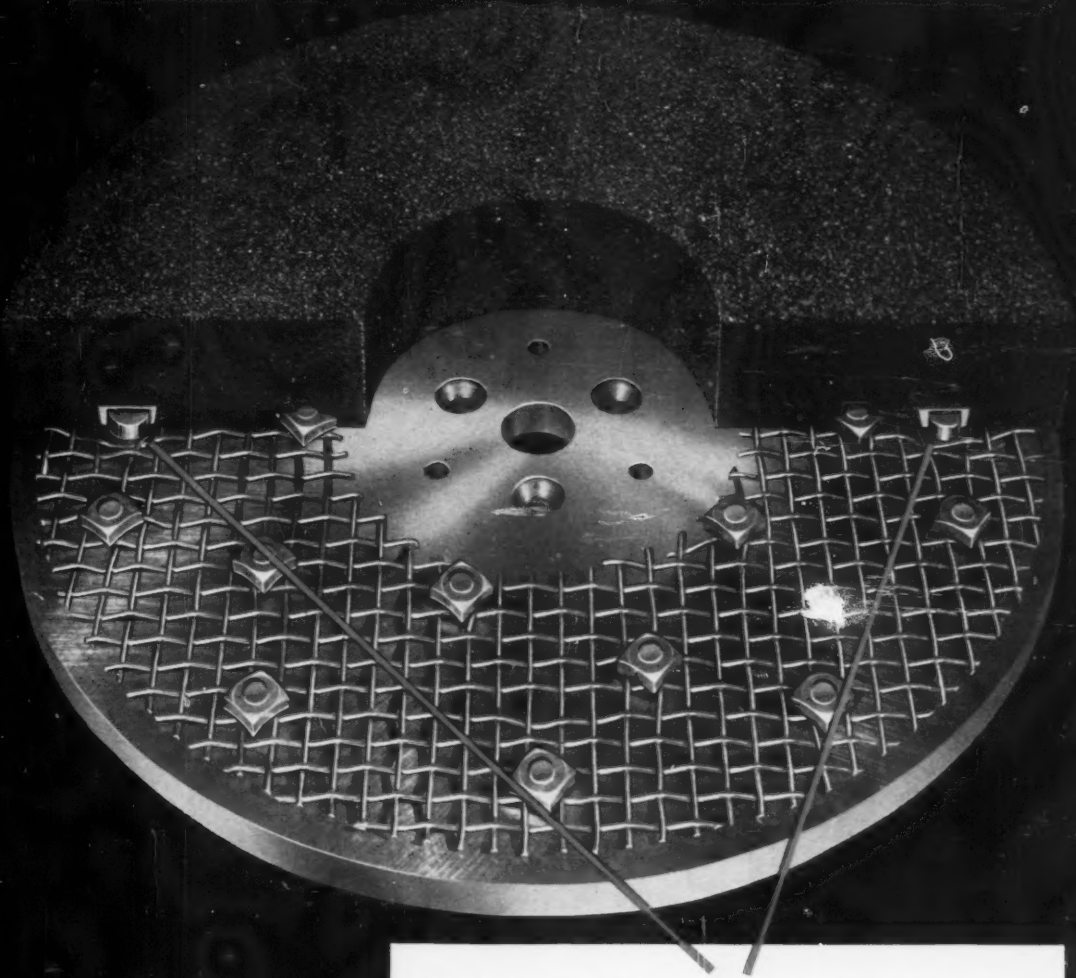
Manufacturers of all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD

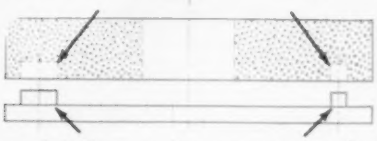
THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

Improved Gardner TRU-LOK® assures precision disc mounting for truer running



Molded, rigid plastic inserts in dowel holes now provide greater accuracy in mounting.



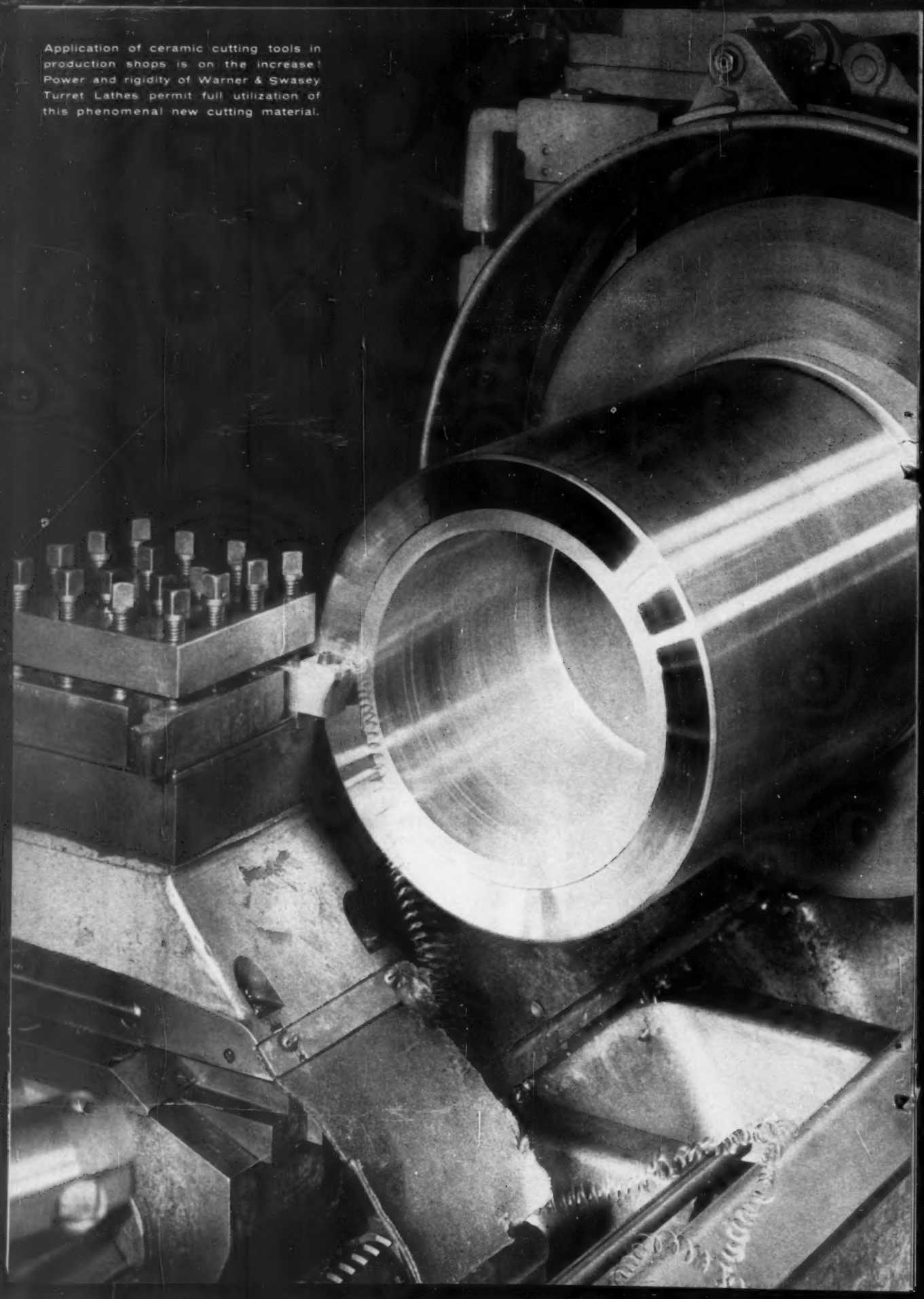
Dowel pins of different diameter in steel wheel must match holes in disc.

Gardner TRU-LOK eliminates run-out and vibration caused by off-center mounting. Disc can be bolted to steel wheel only in position established at time of disc manufacture.

GARDNER

abrasive discs

BELOIT, WISCONSIN



Application of ceramic cutting tools in production shops is on the increase! Power and rigidity of Warner & Swasey Turret Lathes permit full utilization of this phenomenal new cutting material.

Warner & Swasey's continuing Metalcutting Research Program is helping to find...

what Ceramic Tooling can mean to you!

Evaluation of today's new and revolutionary ceramic cutting tools is but another step in Warner & Swasey's ever-continuing metalcutting research program. Only through such constant engineering investigation, study and testing can answers be found to your ever-present question, "How can we machine it better, faster, for less?".

Highlighting the American Society of Tool Engineers' Silver Anniversary meeting at Houston, Texas, March 25 through 27, will be a CERAMIC TOOLING SYMPOSIUM of which Warner & Swasey is proud to be a co-sponsor together with the Massachusetts Institute of Technology and Ohio State University.

A display of ceramic tools and specially-adapted equipment will be featured along with the presentation of technical papers covering ceramic tooling's historical background, laboratory findings and the practical advantages and disadvantages of industrial applications.

A panel discussion by leading authorities will answer your specific questions regarding the potential application of ceramic cutters in your own shop.

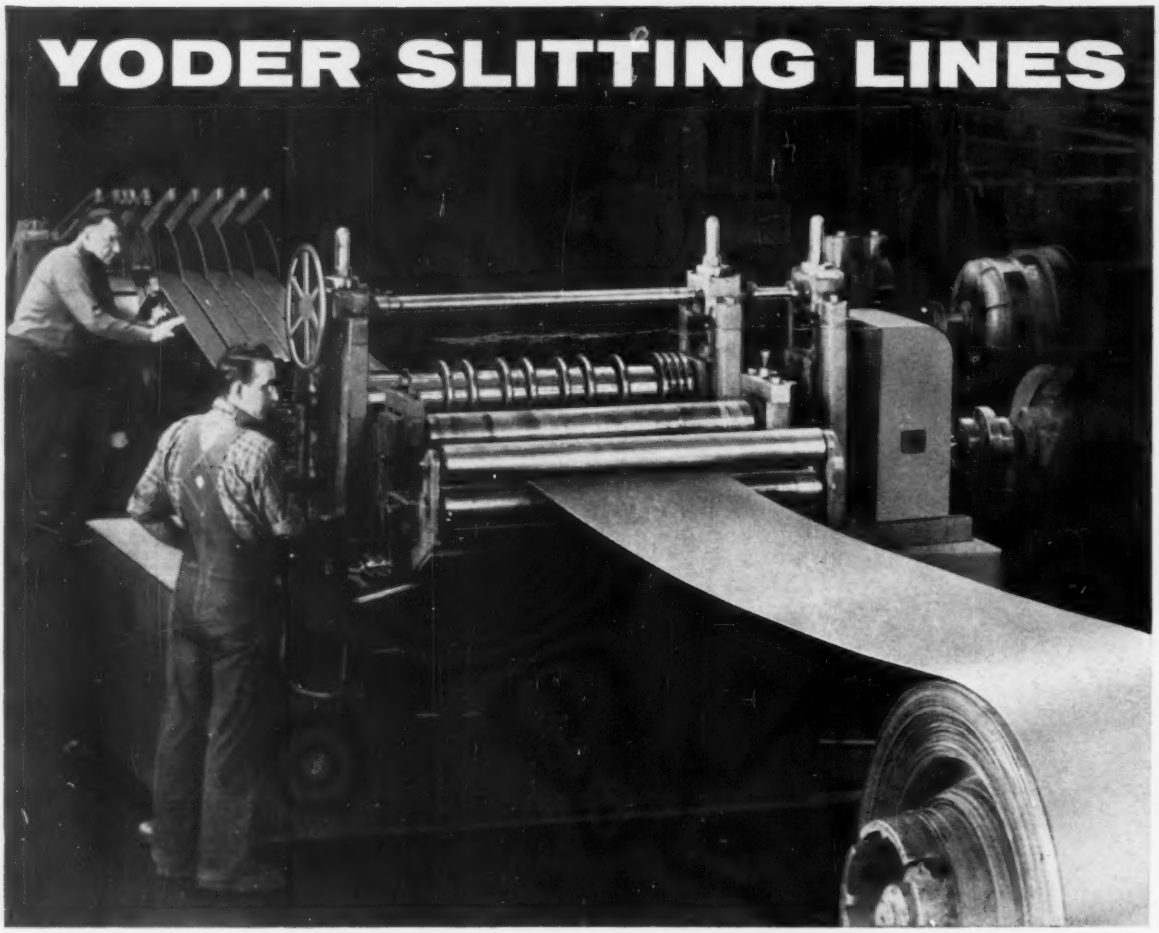
We are looking forward to seeing you in Houston!

SILVER ANNIVERSARY MEETING
MARCH 23-28 1957
HOUSTON TEXAS
CERAMIC SYMPOSIUM

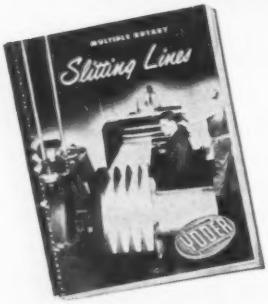
YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YODER SLITTING LINES



pay big dividends working only one day per week!



The Yoder Slitter Book **is a comprehensive treatise on slitter operation and economics, with time studies, cost analyses and other useful data. It is yours for the asking.**

In one plant, two Yoder tube mills and about 50 punch presses are being supplied with slit strands by one Yoder Slitting Line operated an average of only *seven hours per week.*

In another plant, a Yoder slitting line, *operated from six to eight hours per week,* is supplying two intermittently operated roll forming machines with total requirements averaging 100,000 feet per week.

These typical examples demonstrate, first, the big potential output of a relatively small, inexpensive Yoder standardized Slitting Line and, secondly, its big profitability. Assume production of only 35 tons of slit strands per 8 hour shift, one day per week, and the total per year would be 1750 tons. Estimating the saving in slitting cost at only one-half cent per lb., the total annual saving would be $17,500.00.

Besides the big convenience of doing your own slitting, such savings will often repay the investment in a few months.

THE YODER COMPANY 5504 Walworth Avenue • Cleveland 2, Ohio, U.S.A.

ENGINEERING YODER MANUFACTURING

ROTARY SLITTING LINES

COLD ROLL FORMING MACHINES

ELECTRIC-WELD PIPE AND TUBE MILLS

Why Grandmother!

Stories on grinding wheel problems—just like the kind you tell the youngsters—can have a happy ending. And we're writing new ones day after day for plants where high grinding wheel costs and low production have been wolfing up profits.

If *you* are ready to "cry wolf," let us send CINCINNATI (PD)° WHEELS to the rescue. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that can *save you money—and increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, if grinding problems have you ready to shout for help, just contact your CINCINNATI Grinding Wheel distributor. Or, contact us direct and we'll send one of our representatives —men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone—Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you . . .

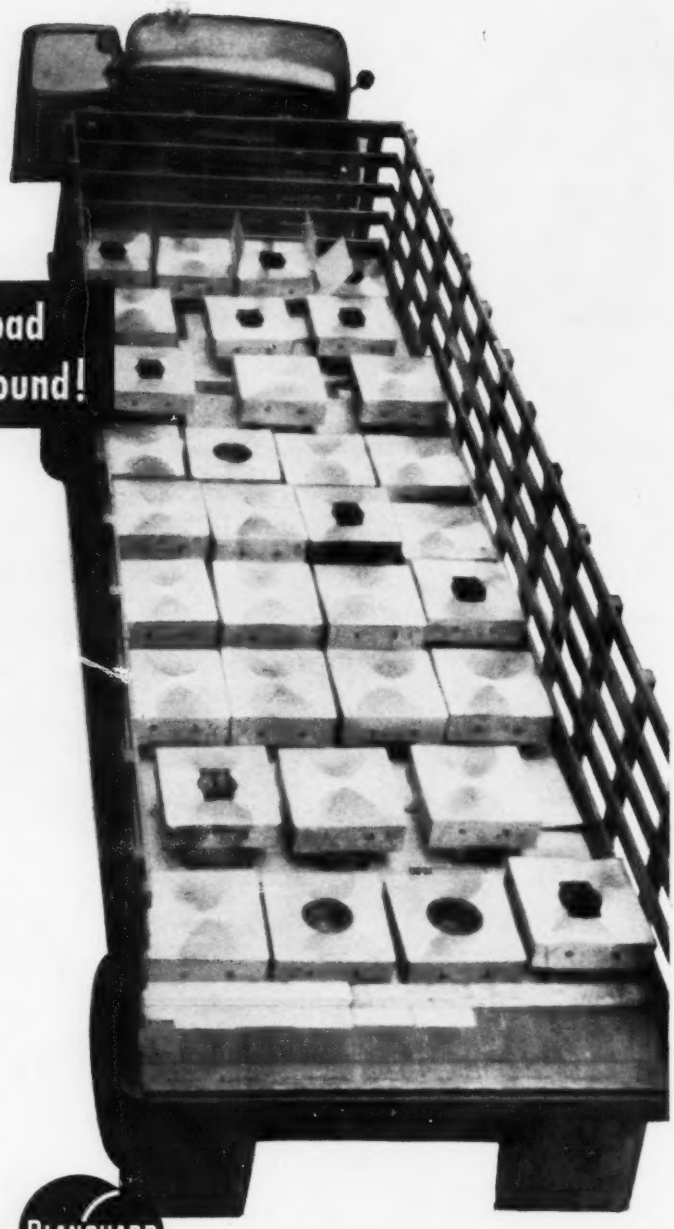
(PD) POSITIVE DUPLICATION

CINCINNATI°
Grinding Wheels

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

°Trade Mark Reg. U. S. Pat. Off.

For more information fill in page number on Inquiry Card, on page 257



Precision by the Truckload -- they're Blanchard ground!

This truck is loaded with 14 tons of steel. Its cargo is 33 soft steel plates, each measuring 27½" x 25½" x 11.125", and ground to ± .001" on a Blanchard Surface Grinder.

Dies up to 84" across corners, can be ground on a Blanchard at great savings. Grinding can be controlled without guesswork—leaving a flat, sharp die—as soon as the entire surface is cleaned up. Die resharpening on the Blanchard allows you to get maximum life from your valuable dies and end plates.

Ask for details on the 15 standard Blanchard models.

For best results in surface grinding . . .

PUT IT ON THE **BLANCHARD**

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS.

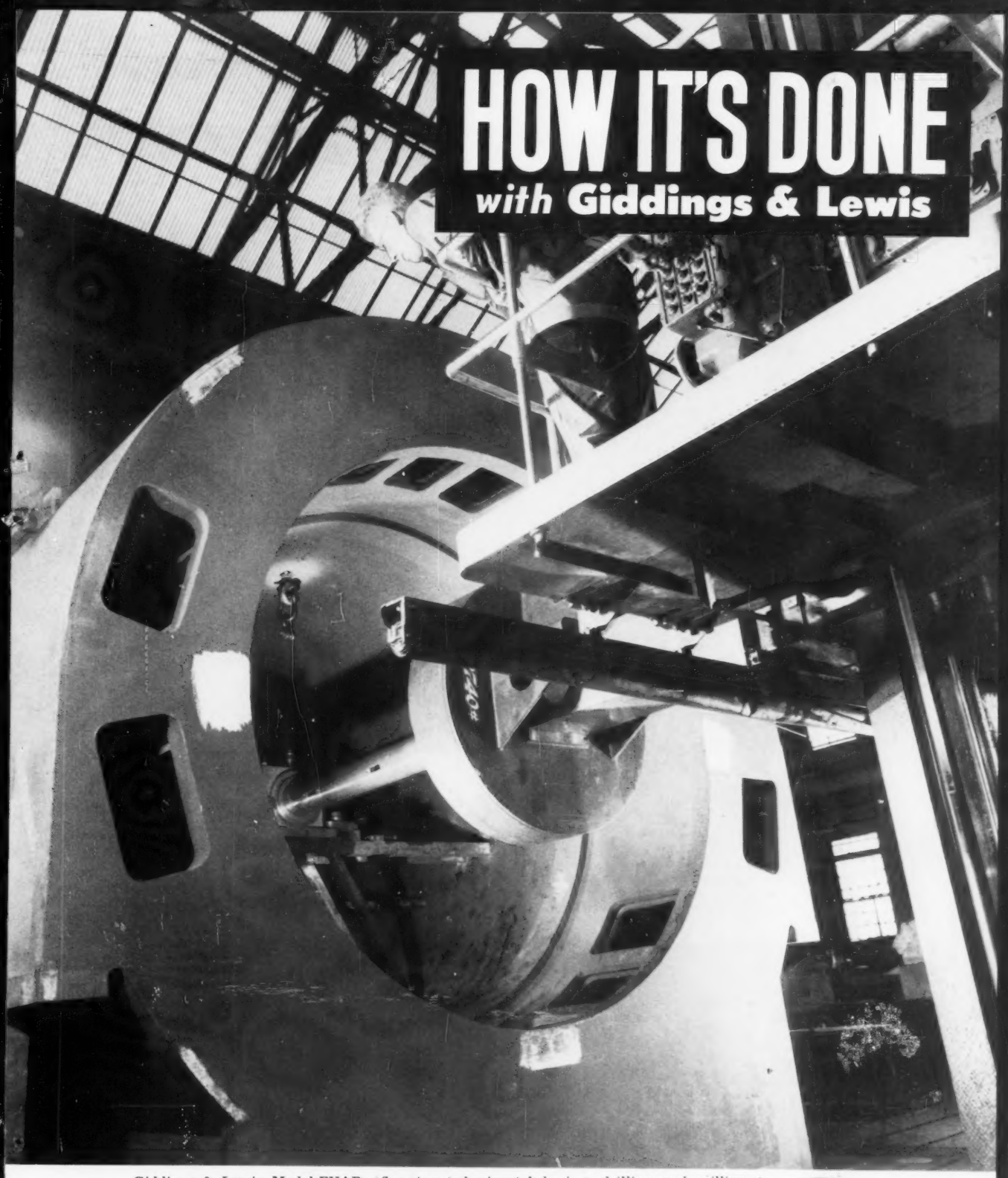
THE BLANCHARD MACHINE CO., 64 State St., Cambridge 39, Mass.

Gentlemen: Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd edition) and "Work Done on the Blanchard" (5th edition)

NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

HOW IT'S DONE



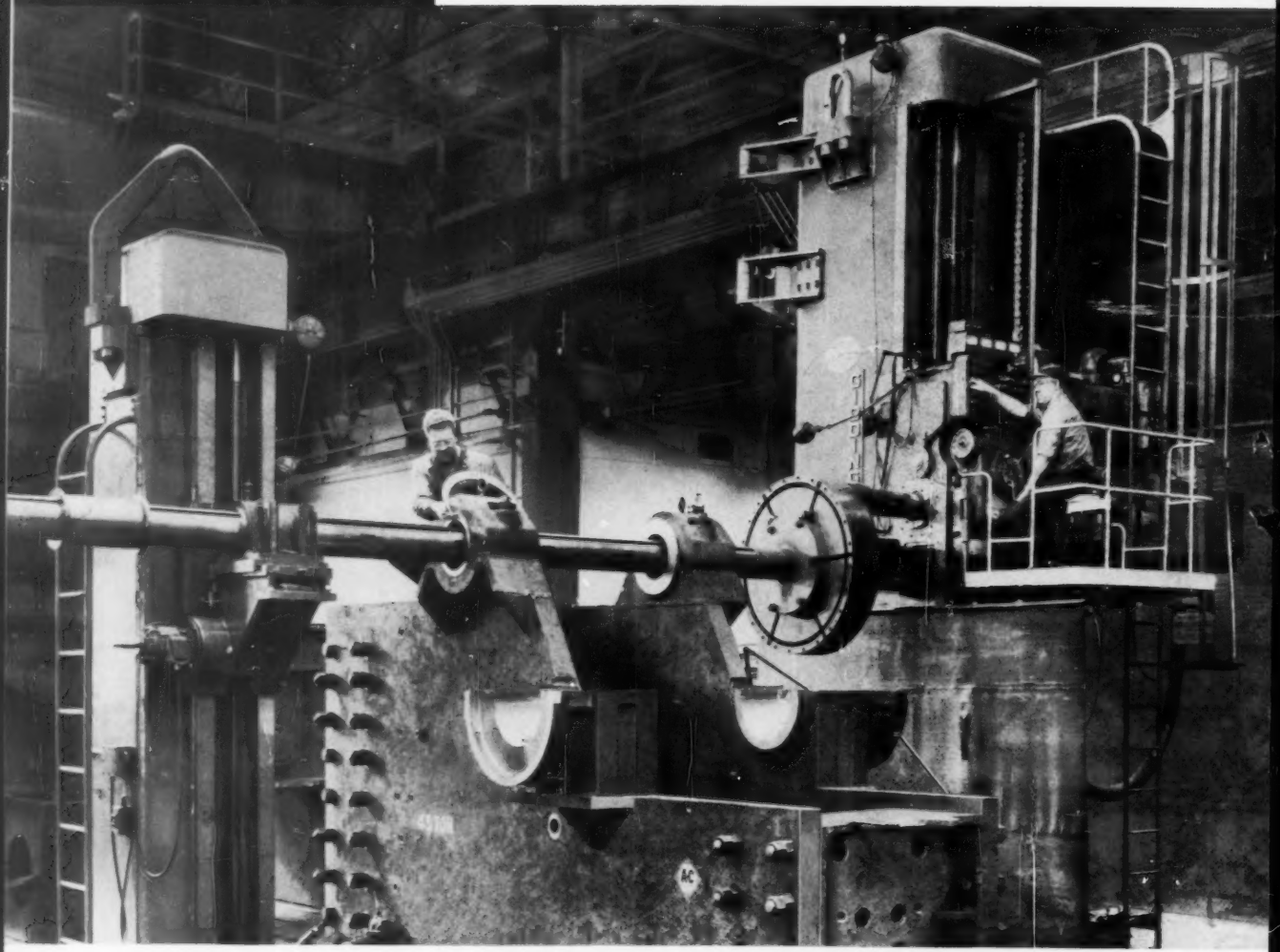
Giddings & Lewis Model-FUAR (floor-type) horizontal boring, drilling and milling machine performs straight-through line boring on stator yoke for a large fully supercharged conductor-cooled generator at Allis-Chalmers Mfg. Co., Milwaukee, Wis. This operation utilizes the G&L face plate drive attachment, mounted on the underarm.

ACTUAL CASE STUDIES SHOW HOW SEVEN COMPANIES MACHINE FOR PROFIT

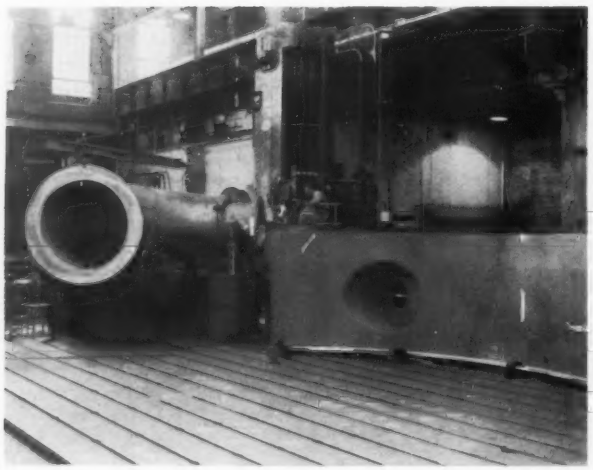
. . . ideas that may trigger new cost-cutting and production methods for you

HOW IT'S DONE
with **Giddings & Lewis**

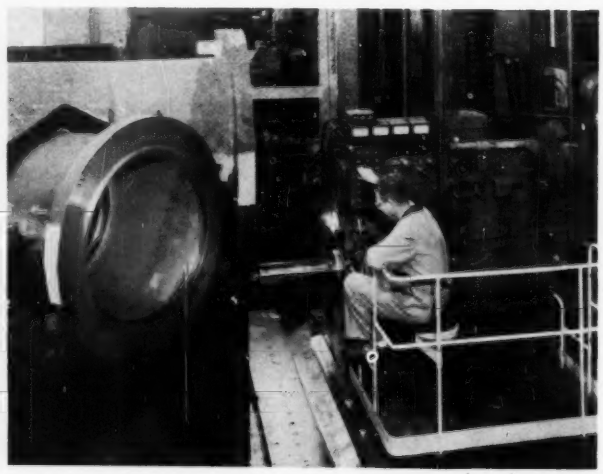
Model 570-FUAR horizontal



Bearing surfaces, flanges and caps on this 45-ton crusher frame — 15'-10" long, 8' high to centerline of upper bearing and 8½' at widest point—are rough and finish bored and faced. Other precision operations include grooving and counterboring.



Here's proof of Model 570-FUAR's versatility. The 20-ton hydraulic turbine spiral casing section and large pit liner are set up on same floor plate. After flange on spiral casing is face-milled, operator moves machine to pit liner for precision boring and facing operations.



Giddings & Lewis Model 570-FUAR horizontal boring, drilling and milling machine, rough and finish turns, faces and grooves four nozzles on this 20-ton hydraulic turbine casing. Here a 76" O.D. x 57" I.D. flange is finish-milled with a 6" face mill cutter.

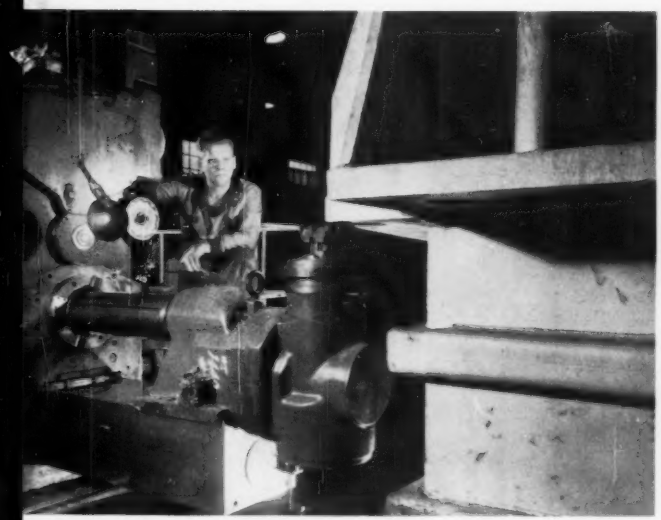
proves productive capacity at Allis-Chalmers

Giddings & Lewis versatile horizontal precision faces, bores, turns, mills and counterbores various surfaces on hydraulic spiral casings . . . steam turbine exhaust casings . . . giant generator yokes . . . swing jaw crusher frames

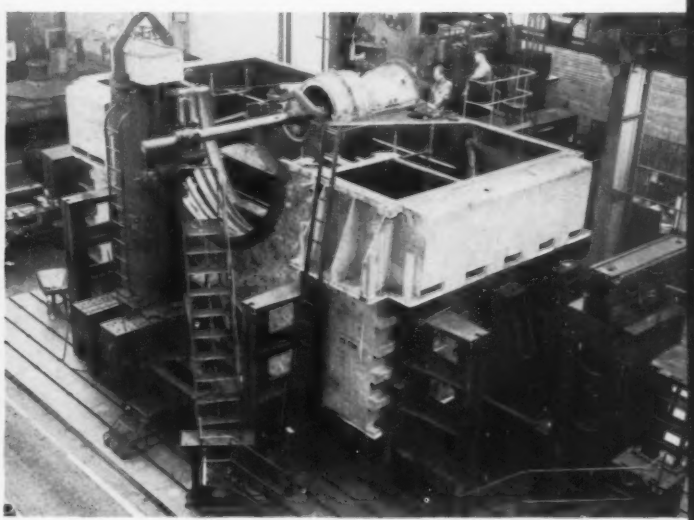
Giddings & Lewis (floor-type) horizontal boring, drilling and milling machine with 7" dia. spindle and a heavy-duty underarm is a busy machine at Allis-Chalmers, Milwaukee, Wis. Equipped with profit-making accessories — 48" continuous feed facing head, 90° angular milling attachment and 46" face plate drive, Davis boring bars and cutters — the Model 570-FUAR is kept busy three shifts per day!

For example: 20-ton hydraulic turbine casing flanges are face-milled at 250 sfm and 20 ipm feed. The 20-foot-long casing measures 76" O.D. x 57" I.D.

The rugged G&L machine precision bores a huge 70-ton stator yoke — 24'-4" long, 13'-2 1/4" high and 13'-3" wide. Operations include boring 104.712" dia. inner rings (plus .005", minus .000") — facing the ends (plus or minus 1/32" overall) and milling the cooler openings. Another important job is finish boring and facing massive 40-ton swing jaw crusher frames. Besides all this, versatile horizontal performs a variety of machining operations on other castings and weldments.



The 90° angular milling attachment, mounted on heavy-duty underarm, makes possible milling of base flange on low-pressure turbine exhaust casing for a large steam turbine.



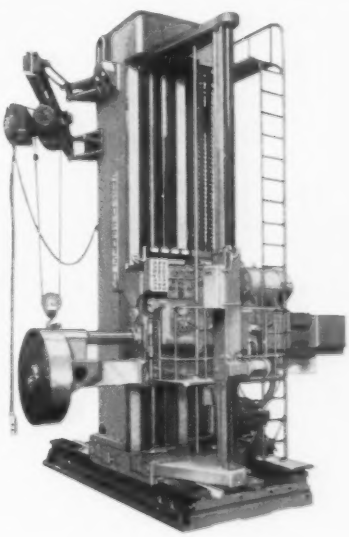
One of the largest weldments to be line-bored and faced is this 95-ton lower half section of welded plate steel casing for one of world's largest steam turbine generator units.

Time-saving optional accessories promote versatility

Giddings & Lewis 50 Series horizontal boring, drilling and milling machines are available with 6" and 7" dia. spindles . . . wide range of speeds and feeds . . . 40-75 hp. They're offered with G&L's *Dupli-Tracer* control and other time-saving accessories such as:

★ Power hoist, mounted integrally with the machine column, facilitates handling and setting up of heavy accessories.

★ Built-in elevator on machine's column enables operator to select the most ideal working position in relation to the headstock and work. Elevator operates independently of the machine headstock.



G & L *and* HYPRO DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO.

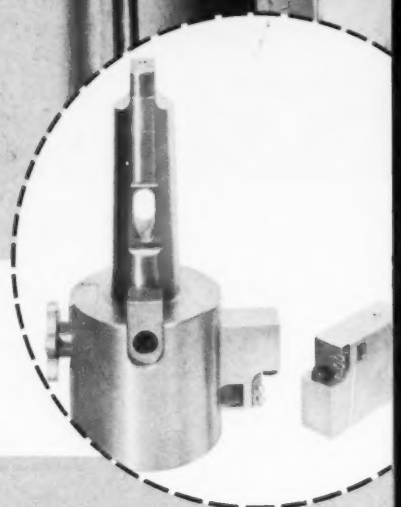
FOND DU LAC, WISCONSIN

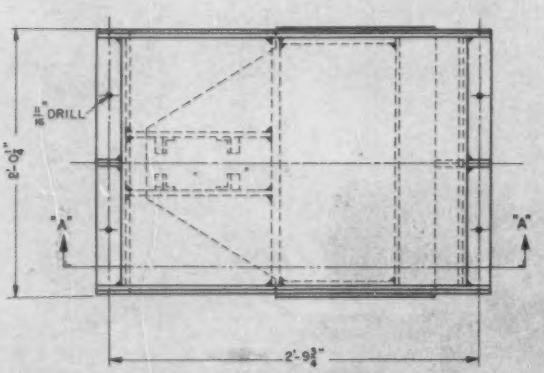
Builder of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

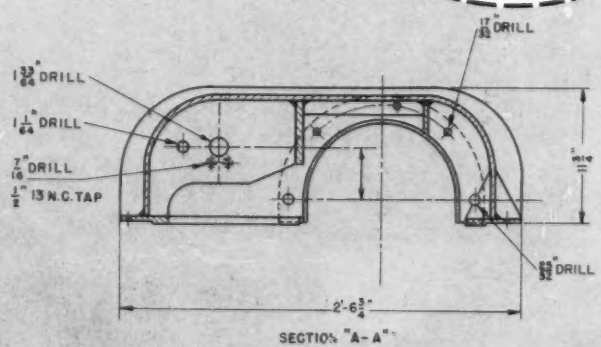
LITERATURE AVAILABLE: *For complete specifications on G&L 50 Series (floor-type) horizontal boring, drilling and milling machines, ask for Catalog No. 50-F.*

HOW IT'S DONE
with Giddings & Lewis

This Super Service Radial drills $1\frac{33}{64}$" hole in an all-steel hoist frame weldment for a 3-ton electric hoist, at 175 rpm, .025" feed per revolution. Other size holes drilled on side, top and inside of frame — in 3 setups — two $\frac{25}{32}$", three $\frac{17}{32}$", four $1\frac{1}{16}$", two $\frac{7}{16}$" and $\frac{1}{2}$" tap (13 N.C.) and one $1\frac{1}{64}$". At right—newly designed Davis special grooving tool cuts two different diameter grooves in gear case covers. This custom-engineered stub boring tool has adjustable cutter blocks with two sizes of tungsten carbide cutters.







Super Service Radial's complete pre-selection of 36 spindle speeds and 18 power feeds including 6 geared positive tap leads assures . . .

high-speed drilling, boring, reaming, spot-facing and grooving of cast-iron hoist gear cases at Harnischfeger Corp.

Constantly operating — almost 24 hours a day — this dependable Super Service Radial (5-ft. arm, 17″ dia. column) with hydraulic pre-selector is extremely easy to operate. Just a turn of the dial makes possible instant and noiseless hydraulic change of all 36 speeds and 18 feeds. And all controls are conveniently grouped.

Installed in the Hoist Shop of Harnischfeger's Milwaukee plant, the Super Service Radial drills, taps and grooves large and small-diameter holes in cast iron gear cases for all sizes of electric hoists — 250-lbs. to 20-tons. The radial is also used for drilling large weldments and components for excavators and overhead electric traveling cranes.

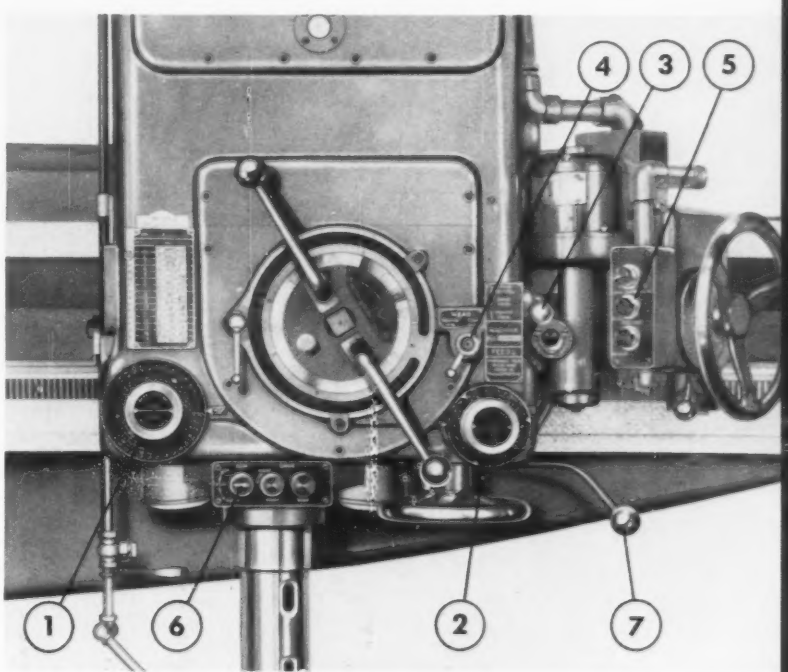
There are ten other shop-proven Cincinnati Bickford Radials serving at Harnischfeger's plants — 3, 5, 7 and 8-ft. arm. In fact a new track-type Super Service Radial with 8-ft. arm will be in operation early this year — while a G&L 7-ft. vertical boring mill is now on order.

For complete specifications on Super Service Radials upright drilling and tapping machines, see your nearest Cincinnati Bickford representative,or write for Bulletins R32 and R33.

Complete hydraulic pre-selection of 36 spindle speeds and 18 feeds

Only a turn of a dial is required to hydraulically pre-select all 36 spindle speeds and 18 feeds on the Cincinnati Bickford Super Service Radial. Speeds and feeds can be pre-selected while the spindle is running in either forward or reverse, or when stopped. After completion of first operation, machine hydraulically and automatically shifts to pre-selected settings, ready for operator to start next operation.

1. New speed dial for pre-selection of any one of 36 speeds for next operation while machine is completing first operation.
2. New feed dial for pre-selection of any one of 18 feeds for next operation while machine is completing first operation.
3. Neutral lever for hand feed operations.
4. Hydraulic head clamp selector button permits dual clamping of head and column simultaneously if desired.
5. Hydraulic column clamping—pushbutton controlled.
6. Power arm elevation and automatic hydraulic arm clamping is easy with convenient single, directional control switch.
7. Handy lever starts, stops, reverses spindle.

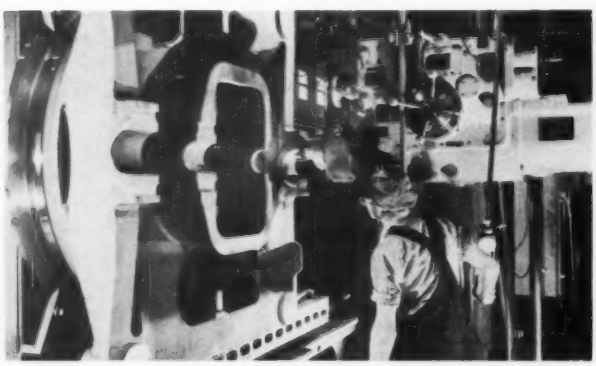


Super Service Radial with track type bases are available. Base is of unusually heavy construction. Hardened steel wheels travel on 80-lb. rails, 4′ gauge. Available in smaller base 36″ gauge using 40-lb. rails. Other standard models from 4-ft., 13″ column dia., to 8-ft., 19″ dia. offered with special bases and table mountings and full range of optional equipment.

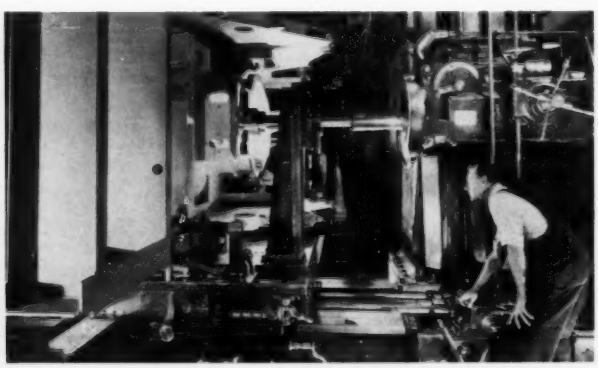
CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
OAKLEY, CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Layout Drilling Machines, Gang Drills and Precision-Drilling Machines designed for use with spacing table.

An 8-ton turntable for a 3-yard Koehring excavator on the Kaukauna horizontal in foreground undergoes a series of drilling and boring operations. For example, 11.251″ dia. bore (plus .002″ and minus .000″) for drum shaft, 6.001″ (plus .000″ and minus .002″) for hoist drum shaft, and 8.126″ (plus .002″ and minus .000″) for tract shaft. Approximately 20 holes from 15/16″ to 4″ are drilled, bored and reamed on one side of the huge turntable.



Three-ton steel plate carbody (6′x5½′x2½″) for Koehring excavator is rough and finish milled on this G&L Model 350-T horizontal. Spindle speed for rough milling is 20 rpm at 2.5 ipm and for finish milling 32 rpm at 3.1 ipm. Ten hours are required to rough and finish mill the corner pads, bosses, brackets; face-mill gear case, hub and bearings.



Operator performs finish boring with 18¼″ dia. Davis cutter . . . spindle speed of 7.6 rpm at .018-ipm feed. Sixteen rough, semi- and finish boring, facing, back-facing and counter-boring operations are performed on this 4-ton turntable — all in 18 hours. Finish machining operations are held to a tolerance of .002″.

HOW IT'S DONE

HOW IT'S DONE
with **Giddings & Lewis**

...12 Giddings & Lewis machine tools help build heavy-duty construction equipment at Koehring Company

perform multiple precision boring operations simultaneously on two Kaukauna horizontals

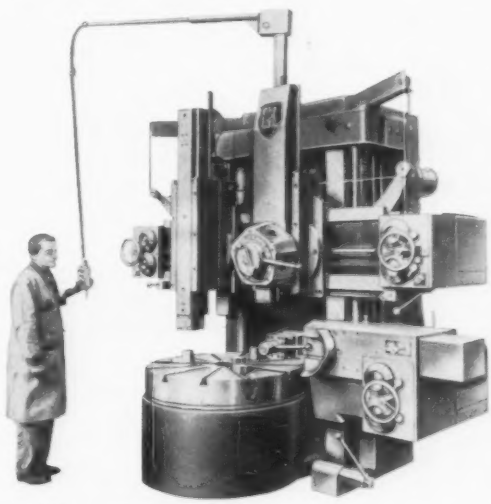
Standing on a common runway 36-ft. long, two Kaukauna Model 3045 horizontals each with 5" dia. spindle (shown at left) perform double duty — boring, drilling and reaming — on large, all-steel weldments for excavators at Koehring Co., Milwaukee. Another Kaukauna horizontal is being added to present runway which is being extended.

The 6' x 45' stationary bed in front of the machine permits use of both horizontals for boring, drilling and reaming operations on the same workpiece, or each machine can be used independently on different workpieces.

A Giddings & Lewis 60" x 96" airlift rotary table is used on the stationary bed to rotate the workpiece and present different surfaces of the part to the machine eliminating crane handling operations. Centralized pushbutton controls, hydraulic spindle speed and feed selector dials plus high power and rigidity are combined to provide operator efficiency and high machine productivity.

In machining turntables for 2 and 3-yd. capacity excavators, each Kaukauna horizontal drills, bores, reams various size holes and faces as many as five surfaces simultaneously. Special fixtures with pilot bushings are used only to assist in directing the Davis boring bar with block-type cutters.

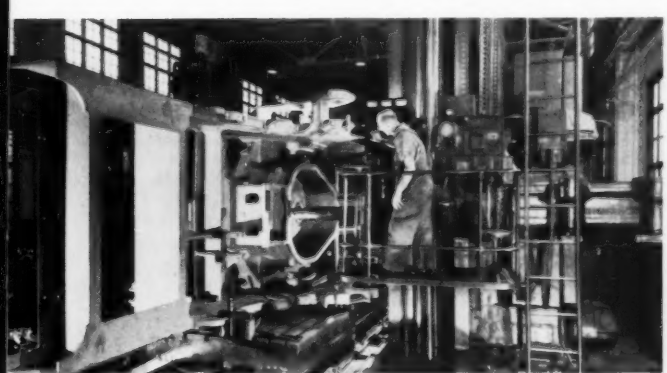
In addition to the Kaukauna machines, the Koehring plant has 10 other G&L machines. There are five other G&L horizontals, two Cincinnati Bickford Radials (6-ft. arm), two HYPRO Vertical boring mills (6-ft. and 10-ft.), and a Giddings & Lewis 42" Vertical turret lathe.



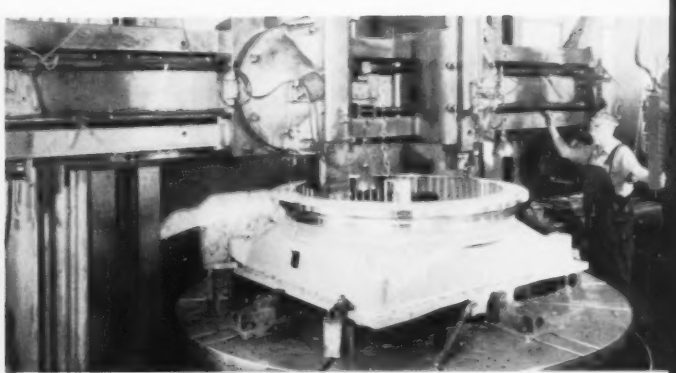
Giddings & Lewis 42" Vertical Turret Lathe.

KAUKAUNA MACHINE & FOUNDRY DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
KAUKAUNA, WISCONSIN

Vertical Turret Lathes, Universal Radial Drilling Machines, Horizontal Drilling, Tapping and Boring Machines and Gray Iron Castings.



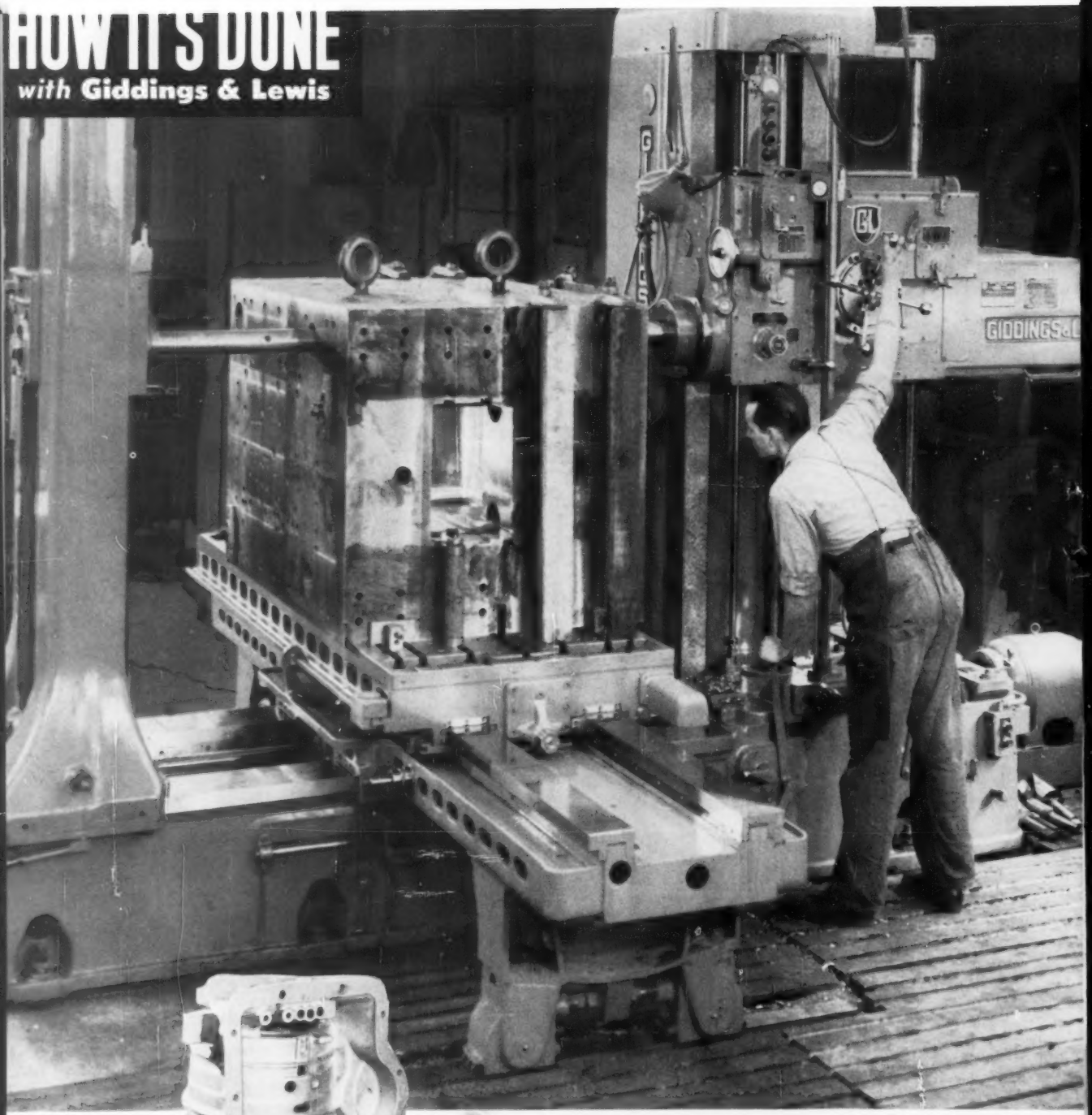
G&L's 560-T horizontal boring, drilling and milling machine with 6" dia. spindle is the most versatile and busiest machine in the shop. Despite massive size of 8-ton turntable, various finish-boring, back-facing, back-and-counter boring operations are held to tolerances of .001" and .002".

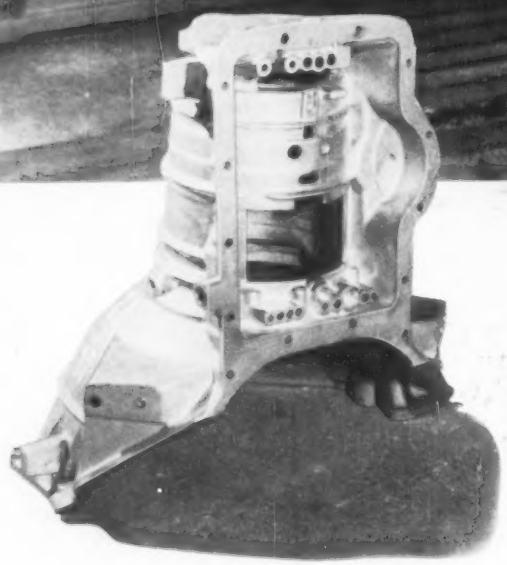


Giddings & Lewis Vertical boring and turning mill, one of two at Koehring, is used for precision machining of large carbodies for excavators. The vertical mill turns control hub, bevels face of ring gear, turns two outer diameters as well as inner diameter on the gear teeth of carbody frame.

Cut 4 tons of tool steel from

HOW IT'S DONE
with **Giddings & Lewis**





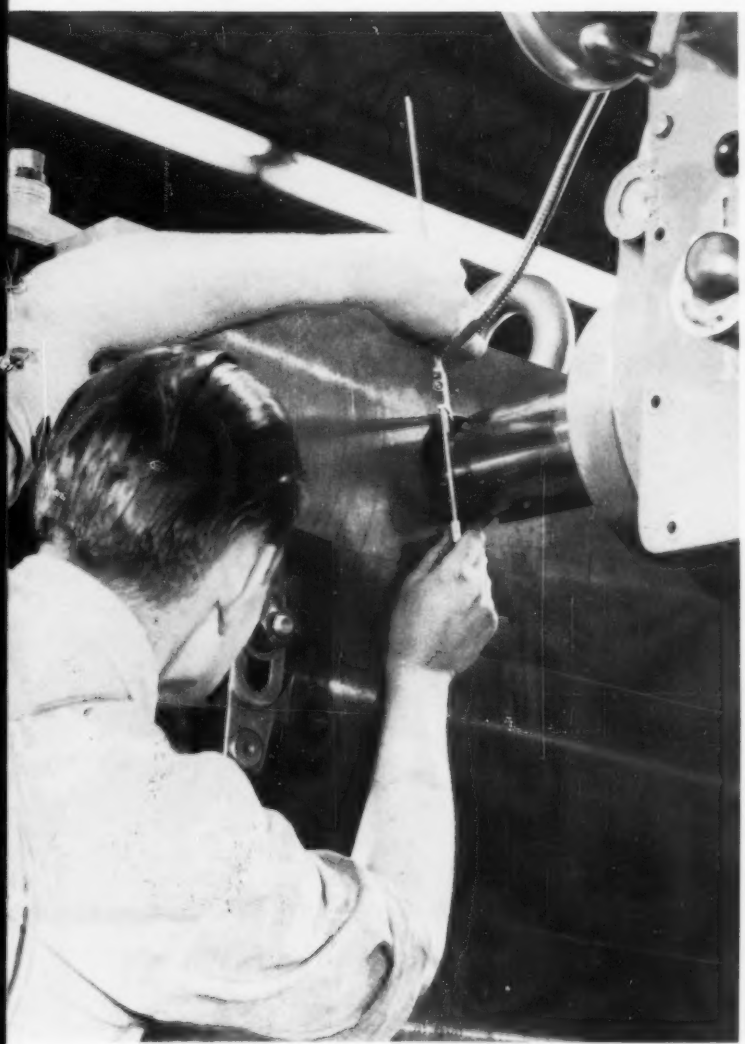
Picture shows G&L's Model 340-T finish boring 3½" dia. hole to a tolerance of plus or minus .001". The machine spindle, with Davis 8' bar, mounting a 3½" dia. cutter block, is used for finish boring. When completely drilled, bored and milled, approximately 4 tons of chips are cut off of huge die blocks.

An aluminum die-cast housing for a popular 1957 automobile automatic transmission is shown. Approximately 20-pound shot of metal is required for each housing. The die mold for precision die casting is one of many types of dies machined on the Model 340-T at Atols Tool & Mold Corp.

HOW IT'S DONE

Cut 4 tons of tool steel from 14½-ton automotive transmission die blocks

with Giddings & Lewis Model 340-T (table-type) horizontal at Atols Tool & Mold Corporation



View of machinist checking inside finish bore diameter (plus or minus .001"), with vernier caliper.

According to Atols' shop superintendent, G&L's Model 340-T horizontal (table-type) has drastically cut production time on boring, drilling and milling of 28,800-lb. die blocks to be used for production of die cast aluminum transmission housings for one of the nation's leading automotive manufacturers. G&L horizontal's remarkable performance is due to its versatility, ease of operation and productivity.

For example, three 2½" dia. angle holes inside the die cavity, 5" dia. bores and 7° tapered holes for core lock pins are drilled and finish-bored to tolerance of plus or minus .001". Counter-bore on the outside surface of the die blocks are machined in the same setup.

After the die blocks are rough-machined, they are heat-treated in Detroit because of their size, and finish-machined at Atols Tool & Mold. Out of total machining time of 2,000 hours, about 400 hours are spent on the G&L machine. Approximately 4 tons of steel are removed.

The Model 340-T with 4" dia. spindle . . . 45 speeds ranging from 10 to 1300 rpm and 18 feeds from .005 to .250 ipm . . . is equipped with extended saddle and saddle support, and in-the-floor auxiliary runways and standard scales and vernier for accurate setting of the headstock and table to .001".

30 Series horizontals are built 4" dia. spindle (20 hp) and 5" dia. spindle (25 hp). They can be furnished with capacity-boosting optional accessories such as angular milling attachments, continuous-feed facing and boring head, automatic electric-operating positioning device, *Dupli-Tracer* (2 or 3 dimensional contour tracing and 360° profiling), plus other time-saving and profit-making accessories.

LITERATURE AVAILABLE: *For complete specifications on G&L 30 Series (table-type) horizontal boring, drilling and milling machines, ask for Bulletin No. 30-T.*

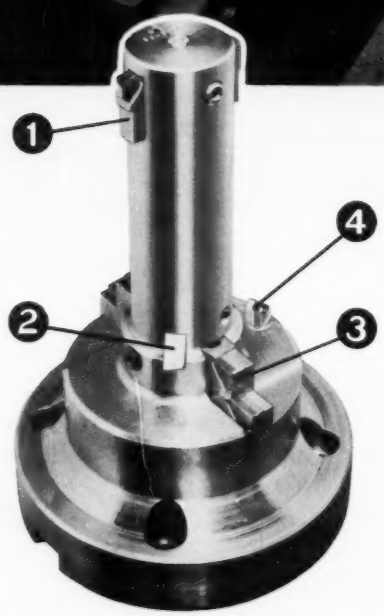
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.

HOW IT'S DONE
with **Giddings & Lewis**

Left way-type boring head with Davis flange-type stub boring bar rough-bores, finish-counterbores, finish-faces and chamfers one end of workpiece, then retracts to original station.

Right way-type boring head with Davis flange-type stub boring bar finish-bores, finish-counterbores, finish-faces and chamfers workpiece from other end. Head then retracts to original station—and machine is ready to receive second workpiece.



Davis special block and flycutter type boring tools perform multiple cutting operations

1. Expandable cutter block with tungsten-carbide cutters to rough and finish-bore three different size bores.
2. ½" square tungsten-carbide flycutter to chamfer (45°) six diameters.
3. Multi-cutter block with 4 tungsten-carbide cutters, 2 tungsten-carbide cutters to counterbore five diameters. 2 tungsten-carbide cutters to face five diameters.
4. ½" square tungsten-carbide cutter to chamfer (45°) seven different diameters.

HOW IT'S DONE
with Giddings & Lewis

Creative tooling pays off at Baldwin-Lima-Hamilton

Two spindle horizontal performs multiple machining in a single pass — thanks to custom-built Davis stub boring tools

This specially built Kearney & Trecker two-spindle boring machine is equipped with two sets of Davis-designed and engineered flange-type stub boring bars that really pay off in production! These high-efficiency Davis tools bore, counter-bore, face and chamfer—in a single pass—various sizes of tread rollers for crawler-type construction machinery at Baldwin-Lima-Hamilton Corp., Lima, Ohio.

Here's how Davis does it! Each standard way-type boring unit, located on opposite ends of the machine, is equipped with a Davis flange-type block and flycutter-type boring tool. The left boring head machines one side of the workpiece, retracts — and the right head machines its side of the tread roller.

Each Davis-designed stub tool has an expandable two-cutter block, a multi-cutter block with four cutters and two angular fly cutters—all with tungsten-carbide cutter tips.

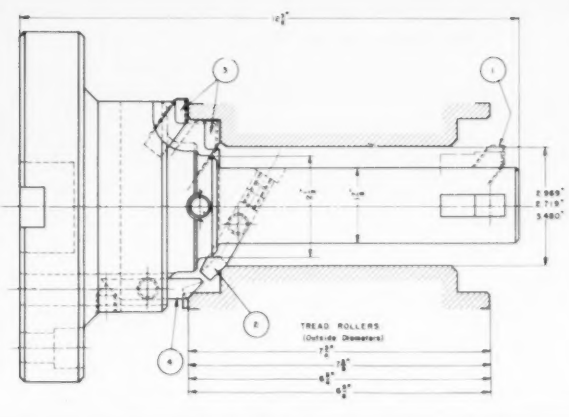
The cutters — located at different distances and positions on the stub boring bar — perform a remarkable sequence of machining operations as the spindle feeds into the workpiece.

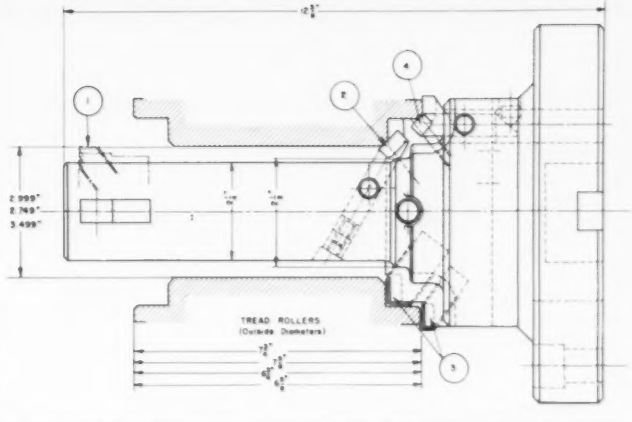
Davis offers a complete line of standard blocks, boring heads, bars and tool sets, and custom tooling service to solve any routine or special boring problems. See your local Davis field engineer. Write for Catalog No. 304.

DAVIS BORING TOOL DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN
Line and Stub Boring Bars, Boring Heads, Block-Type Cutters, Planing and Turning Tools, and Special Production-Engineered Job Tooling.

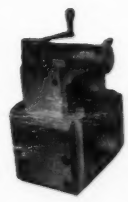
Special block and flycutter type boring tools . . . . . .

(Left hand cutters) **(Right hand cutters)**





Davis offers a complete line of standard boring, turning and planing tools


Extension Boring Head

Stub Boring Tools with Unfinished Shanks

8-Position Tool Holders

3 and 1 Boring Head

Line Boring Bar with 3 and 1 Boring Head

L Type Boring Tools

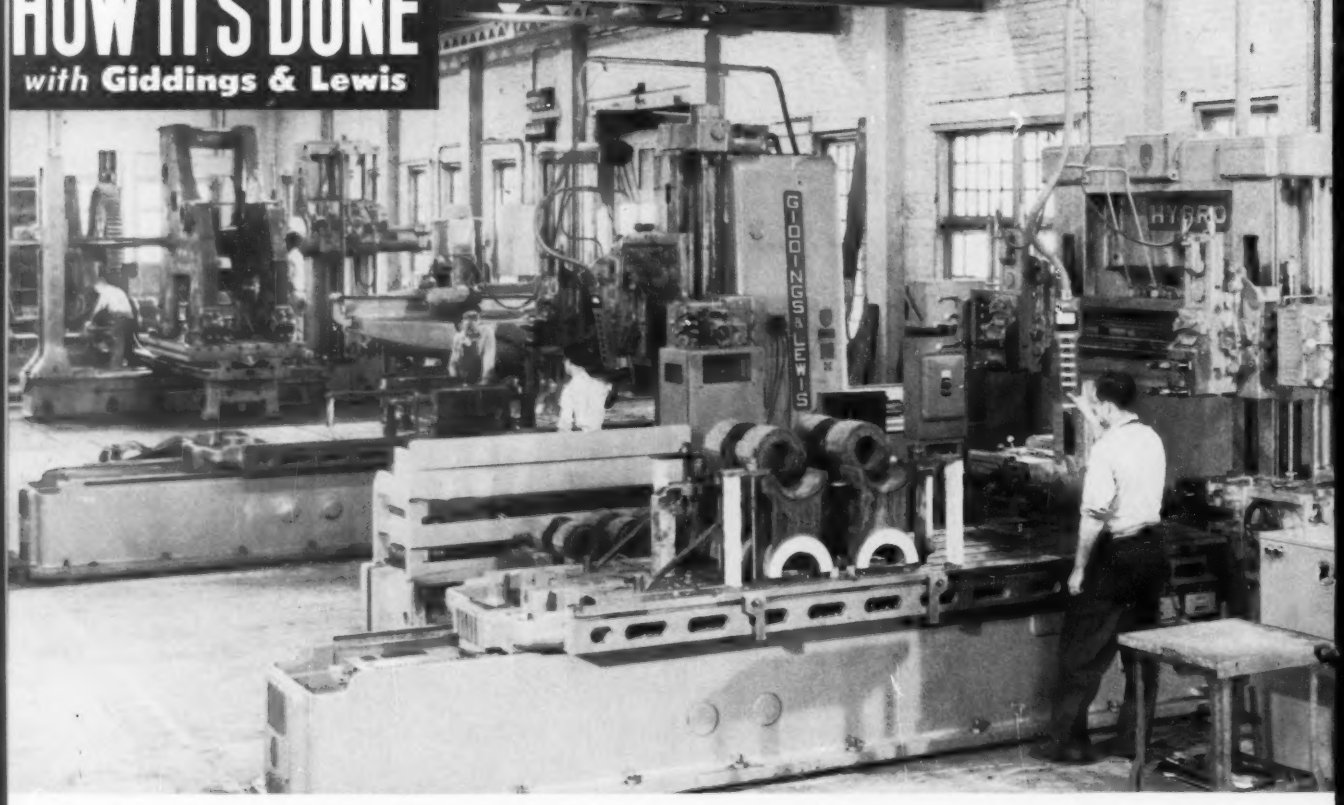
Carbide Tip Planer Tools

Quick Change Arbor and Sleeves

Interchangeable Block Type Tooling

Micrometer Adjustable Stub Boring Tool Set

HOW IT'S DONE
with **Giddings & Lewis**



Four of five G&L machines used for various machining operations on Boyd mechanical brick presses are HYPRO double housing planer and openside planer, Super-Service Radials (6-ft. and 4-ft. arm) and Model 350-T horizontal. Another Model 350-T horizontal boring, drilling and milling machine will be installed in 1957.

Chisholm, Boyd & White reports:

"ease of set-up, precision machining at lower cost, more production of mechanical brick presses on five Giddings & Lewis machines"

. . . these are the words of Frank Hevrdejs, works manager of Chisholm, Boyd & White, manufacturers of Boyd Brick Presses, Chicago, Illinois.

As illustrated in photo above, rough and finish-boring and facing operations of large holes on 8½-ton Model "Y" brick press frames are performed on G&L's horizontal.

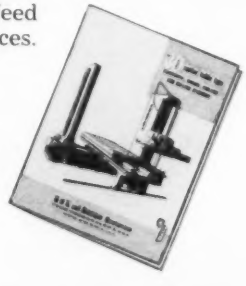
The versatile Model 350-T, with 5" dia. spindle, is equipped with extended saddle, saddle supports, and auxiliary in-the-floor type runways which easily handle a casting — 108" by 110" by approximately 10" thick — weighing 4½ tons.

Prior to boring, the bases and vertical surfaces on the frame are planed on a Giddings & Lewis 48" HYPRO double housing planer.

On the Model 350-T machining time is reduced considerably because the operator can quickly position table and headstock for bores at different locations, and use of machine's vernier scales has resulted in 2½-hour reduction in floor-to-floor time . . . a real time savings.

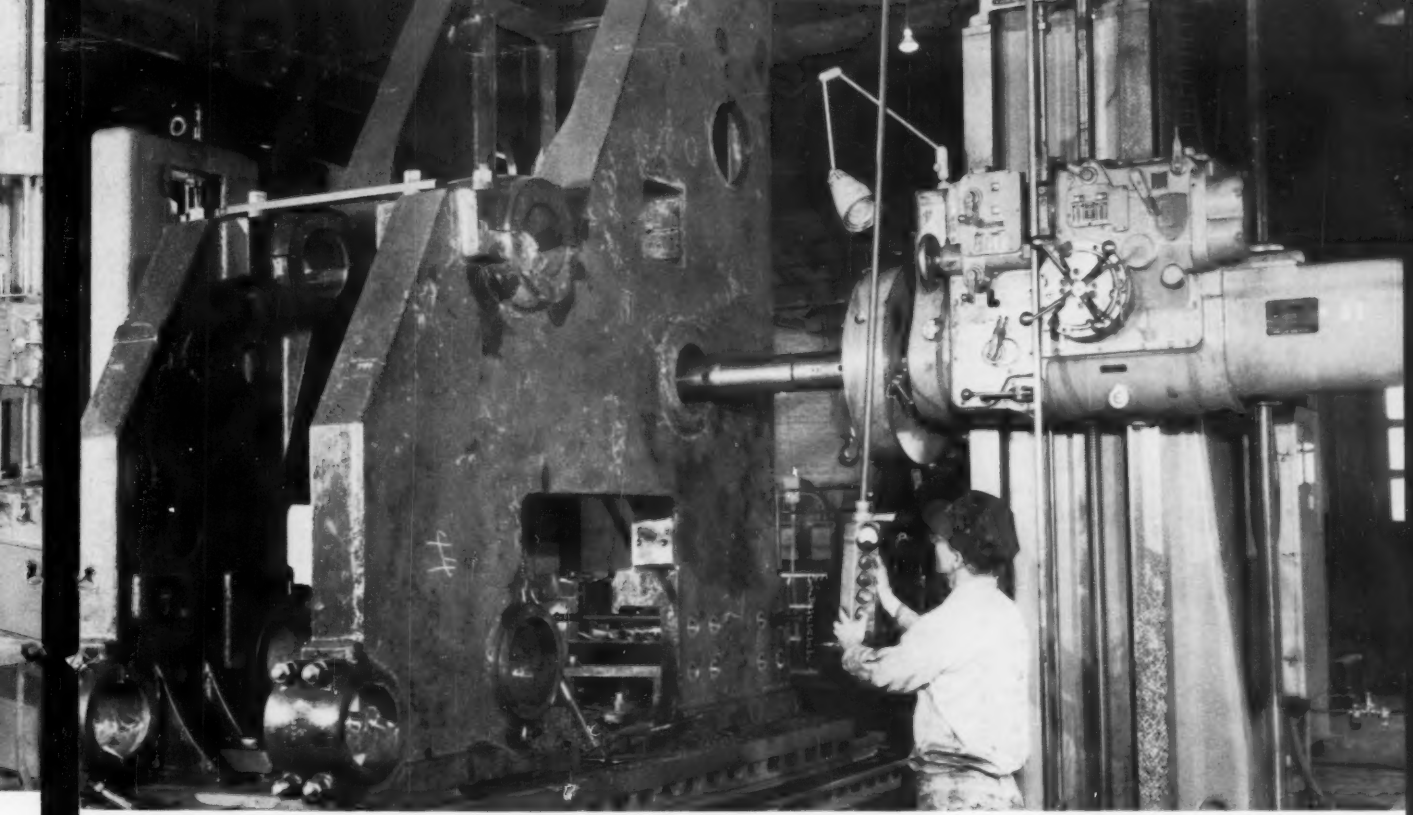
Davis 5" dia. line-boring bar with block-type carbide-tipped cutters is used for precision boring. Accuracy required: plus or minus .001".

Bearing surfaces are faced with G&L's continuous-feed facing head to close tolerances.



For complete specifications on G&L 30 Series (table-type) horizontal boring, drilling and milling machines, contact your nearest G&L representative, or write for Bulletin No. 30-T.

HOW IT'S DONE
with **Giddings & Lewis**



Model 350-T (table-type) horizontal rough and finish bores four 5" dia. holes to plus or minus .001" tolerance in both right and left frames of Boyd Brick Press using Davis boring bars and block-type cutters.

Optional arrangements and equipment include:

1. Built-in rotary table with power drive eliminates numerous work set-ups.

2. Automatic electric positioning device for both headstock and table travel assures accurate machine setup, repetitive to .0002".

3. Improved measuring device with dial indicators and precision end measures . . . readings to .0001".

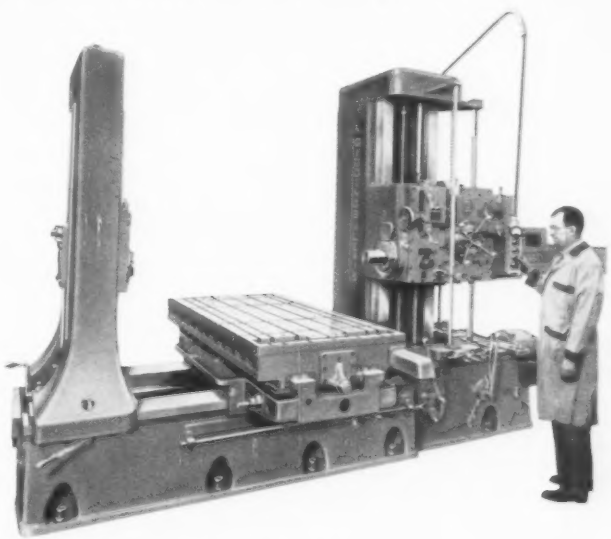
4. Built-in precision thread lead device for cutting of precision threads to any standard prescribed form, pitch and depth.

5. Super-sensitive *Dupli-Tracer* for 2 or 3 dimensional stepless contour tracing and 360° profiling.

6. Exclusive G&L "Lubri-Cool" system connected to headstock and milling feed for machining accuracy under heavy loads and high ambient temperatures.

7. Continuous feed facing head, mounted to the spindle sleeve or one line boring bar, for machining external or internal surfaces beyond the range of the machine spindle.

8. Various angular milling attachments for milling angles and hard-to-reach surfaces.

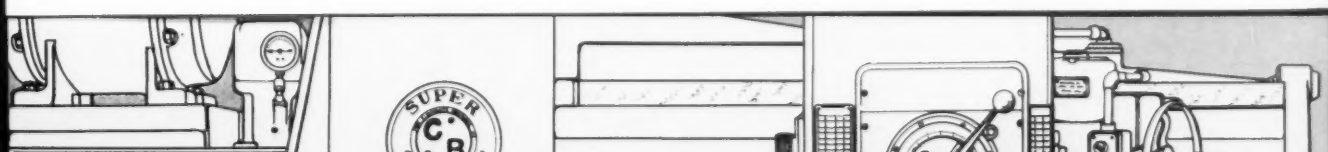


30 SERIES HORIZONTALS

Two popular horizontals in the 30 Series line are the Model 350-T with 5" dia. spindle (25 hp) and Model 340-T with 4" dia. spindle (20 hp). Other G&L horizontals with spindle diameters ranging from 3" to 14", main motor drives 10-150 hp, are available.

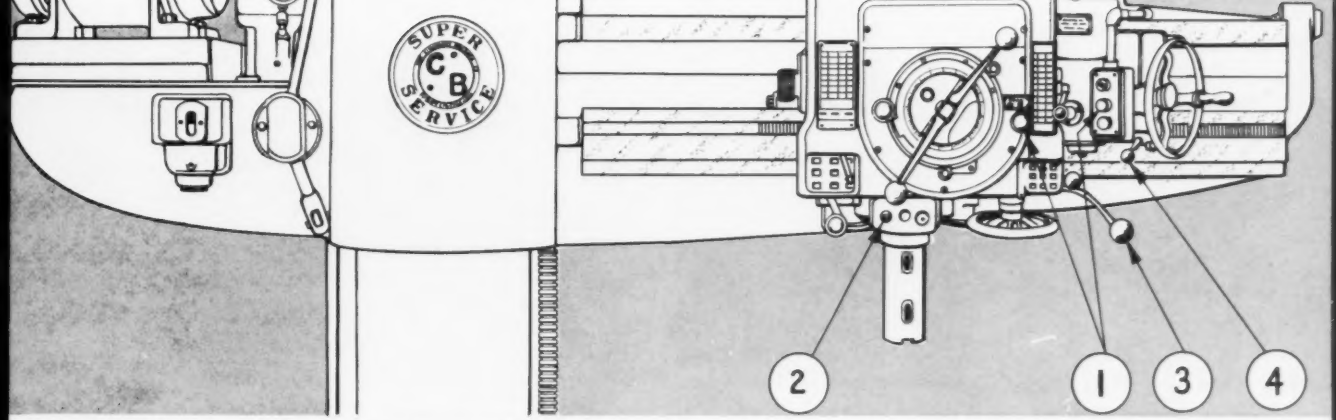
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers, Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.



HOW IT'S DONE
with **Giddings & Lewis**

Production drilling of a standard die shoe, 20″ x 26″ x 2″, for an all-steel die set is done on a Cincinnati Bickford Super Service Radial. A total of 12 holes is drilled: four 1¾″ dia. at 145 rpm, .020″ feed per revolution, and eight $\frac{27}{64}$″ dia. holes, and ½″ — 13 thread tap. After dies are drilled and tapped, they are placed on a roller conveyor which moves the piece to a precision boring machine.



Simplified, centralized controls provide—

1. Finger-tip operation of powerful hydraulic head and column clamp.
2. Fast power-arm elevation with automatic clamping.
3. Easy-to-reach spindle control for start, stop and reverse.
4. Rapid head movement with power traverse.
5. Automatic pressure lubrication to arm barrel and elevating nut.

Die-set drilling production increased 25 to 30%!

They're doing it at Superior Steel Products with a Cincinnati Bickford Super Service Radial

An increase of 25-30% in the production drilling and tapping of all-steel (SAE-1018) precision die sets of various sizes on a Cincinnati Bickford Super Service Radial with 5-ft. arm, 17-in. dia. column is enjoyed by Superior Steel Products Corporation, Milwaukee, Wis.

Principal reasons for this outstanding production, according to Edward Mezydlo, plant superintendent, are: Radial's simplicity enables operator to quickly change from one speed to another permitting instant selection of all 36 spindle speeds, 12 to 1500 rpm. There are 18 feeds ranging from .004" to .125" per revolution. These include six tap leads, 8 to 27 threads per inch.

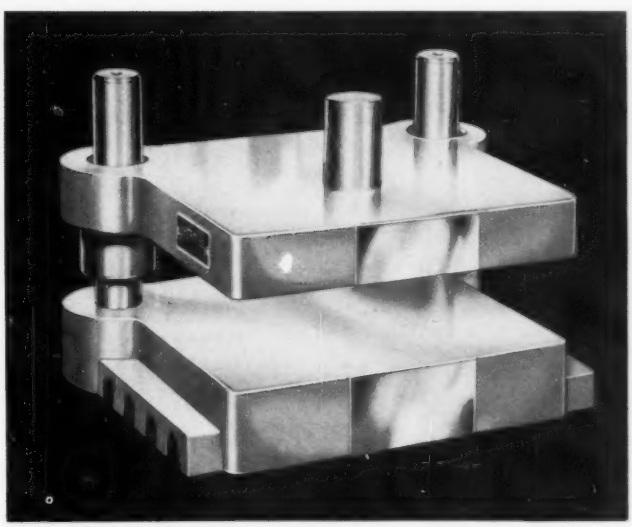
The hydraulic clamping of column and head is simple, easy and quick. It permits drilling a variety of holes to a greater degree of accuracy.

Superior all-steel die sets range in size from 3" x 3" to 40" x 120" . . . thickness varies from 1¼" to 5". Superior also produces precision guide pins, bushings and bolster plates.

Because of the Super Service Radial's performance, a new 6-ft. C.B. Radial with 19" dia. column has recently been installed at Superior. It replaces a competitive heavy-duty radial.

CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
OAKLEY, CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Layout Drilling Machines, Gang Drills and Precision-Drilling Machines designed for use with spacing table.



Superior precision all-steel die set with safety flanges drilled on Super Service Radial.

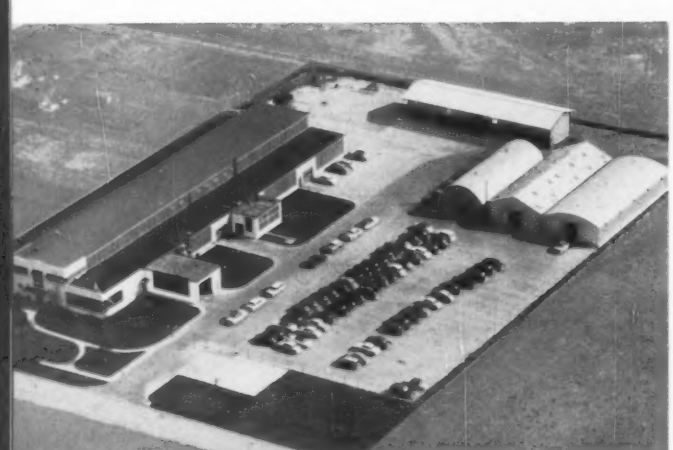
Precision checking of accurately drilled and bored die set which meets rigid quality standards.

G&L and HYPRO Division — operates one of the finest machine tool plants in the world devoted to the design and manufacturing of heavy-duty precision machine tools.

Cincinnati Bickford Division has a reputation as a leader with their line of Super Service Radial drilling machines. This division was acquired by G&L in 1955.

Serving the metalworking industry throughout the world for more than 96 years . . .

Giddings & Lewis has been in continuous operation since 1859 and is the foremost designer and manufacturer of an extensive range of precision heavy-duty machine tools, accessories, attachments and cutting tools. The growth of G&L to a point where it comprises four individual operating divisions with a combined manufacturing space totaling over 750,000 square feet serves to illustrate the importance of vision and alert engineering — plus capacity to produce. The developing of ideas . . . their proper evaluation . . . and the constant striving to build products that are the best in their class — all have combined to make Giddings & Lewis a major force in metal-working programs of American industrial life.



Davis Boring Tool Division manufactures a complete line of boring, planing and turning tools for performing virtually any machining operation. G&L acquired this division in 1945.

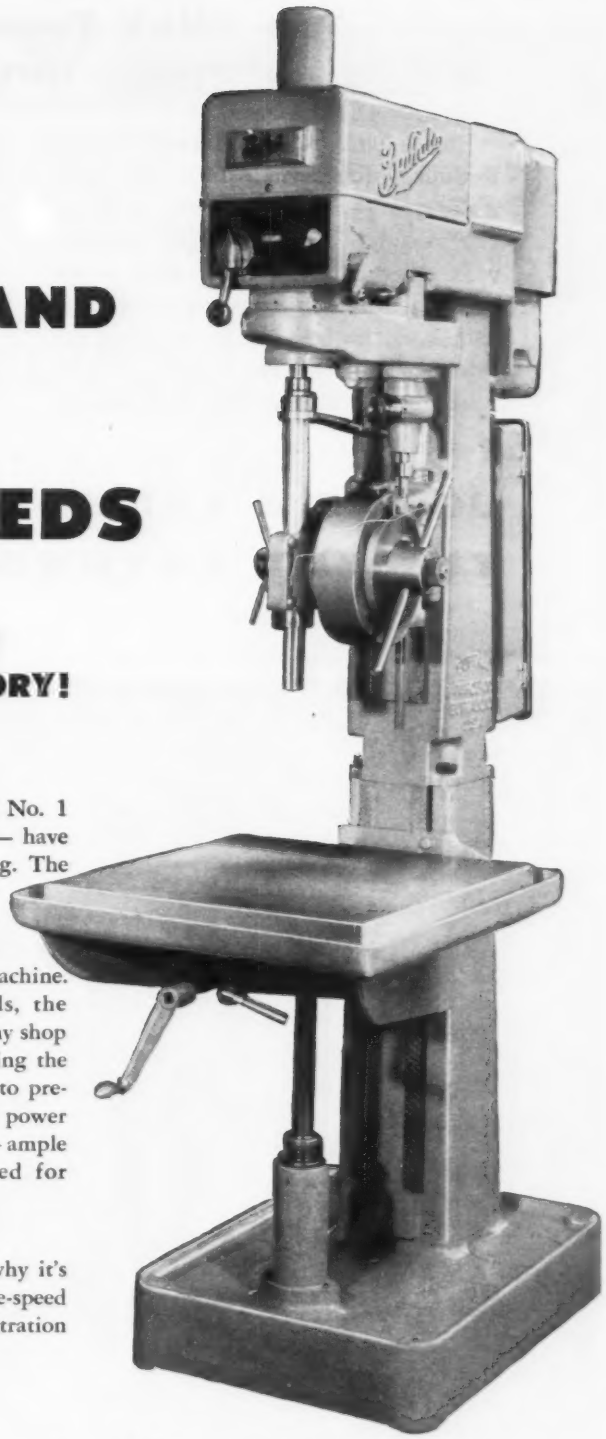
Kaukauna Machine & Foundry Division designs and manufactures Vertical Turret Lathes, Universal and Horizontal drilling and boring machines. This division was acquired by Giddings & Lewis in 1955.

GIDDINGS & LEWIS MACHINE TOOL COMPANY

FOND DU LAC, WISCONSIN

IN THE OPERATOR'S HAND —1001 DRILLING SPEEDS

— PLUS THE SMOOTHEST OPERATION IN DRILL HISTORY!



The gearless variable speed drive in the new No. 1 "RPMster" — plus "Buffalo" craftsmanship — have brought a new smoothness and ease to drilling. The shift handle at left places the drive in high or low range, while the dial at right provides infinite variations in either range. They're easily reached, as are all controls on this 88"-high machine. Made in one-to-six spindle pedestal models, the "RPMster" has long-life and accuracy features any shop man will appreciate — all moving parts including the precision spindle machined *after* heat treating to prevent warpage — hand scraped ways — "Buffalo" power feed — strong, rigid, stable base and frame — ample work tables — all parts carefully hand-fitted for permanent accuracy.

But you have to operate an "RPMster" to see why it's literally the finest value in vibration-free, variable-speed drilling available. Write for details on a demonstration at your "Buffalo" machine tool dealer's.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

For more information fill in page number on Inquiry Card, on page 257

The ONLY Turret Lathe with a fully automatic thread-chasing cycle!

Here is full turret lathe versatility and a threading attachment with a fully automatic cycle — all in one machine. Now you can be sure of concentricity of threading with other lathe work, *all done in one chucking*, with the time saving of the Auto-Threader! Nowhere else in the world can this be found on a turret lathe.

This Auto-Threader will chase straight or taper threads — or a combination — internal or external, from the front of the machine.

Concerning this J&L development, a customer writes: "We are tripling production on many of our items."

Write for descriptive folder No. 5440. JONES & LAMSON MACHINE COMPANY, 512 Clinton Street, Springfield, Vermont.

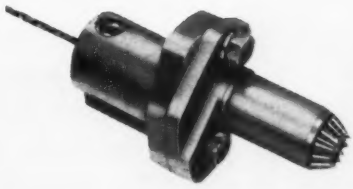
JONES & LAMSON TURRET LATHES

the man who needs a new machine tool is already paying for it

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools Thread & Form Grinders

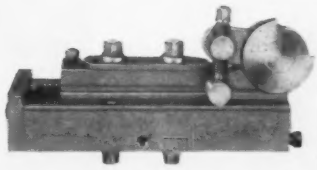
Announcing

New Additions to the RIGHT R and L LEFT Family! . . .



NEW ON AND OFF CENTER DRILLING ATTACHMENTS

This ingenious turret drilling attachment is designed to save you second set-up time. It is no longer necessary to remove the cut-off piece in order to drill an off-center hole in the end of a bar. Merely stop the spindle, bring this tool into the work and continue the operation. The tool will operate within the capacity of the machine. (Available in ⅝", ¾" and 1" diameter shanks.)



NEW TOOL HOLDERS FOR MULTI-SPINDLE AUTOMATICS

This tool holder, made for circular tools, can be used on the front or rear cross-slide of multi-spindle automatics . . . It is made to operate within the capacity of the machine.

NEW TOOL-SLIDE KNURLING TOOL FOR MULTI-SPINDLE AUTOMATICS

This tool can be used in the tool-slide of multi-spindle automatic screw machines or in the turret of turret lathes. The knurls may be adjusted for various diameters by turning them on an eccentric shaft . . . The tool will operate on any diameter within the capacity of the machine. (Another new R and L TOOL is the Cross-Slide Knurling Tool for Multi-Spindle Automatics.)

Write for complete catalog of R and L TOOLS and literature and prices on these new tools.

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

☐ Please send me your new catalog

☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME .....

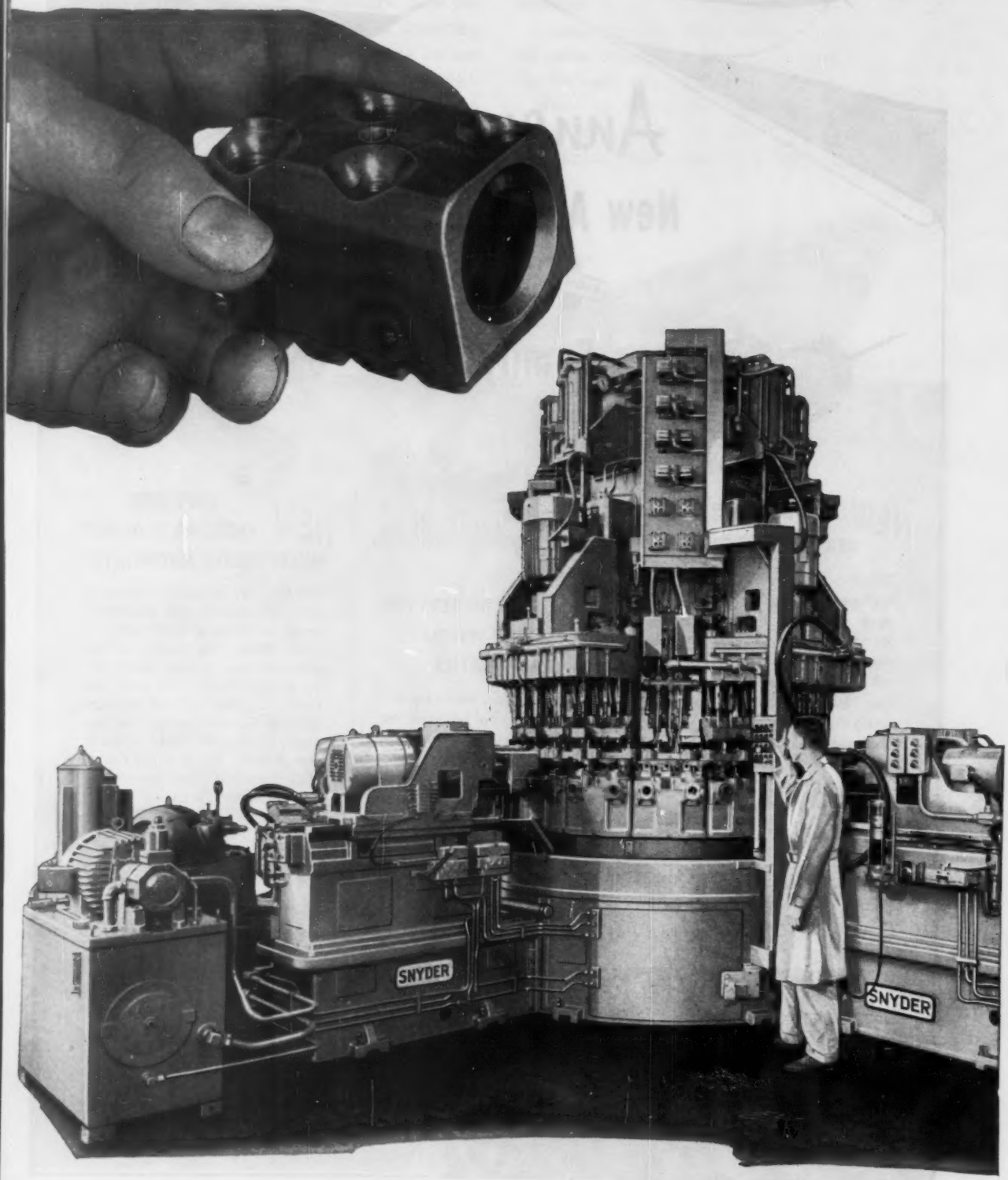
COMPANY .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

For more information fill in page number on Inquiry Card, on page 257

Simplified Automation in Successfully Applied in New



Machining Small Parts is Snyder Center Column Machine

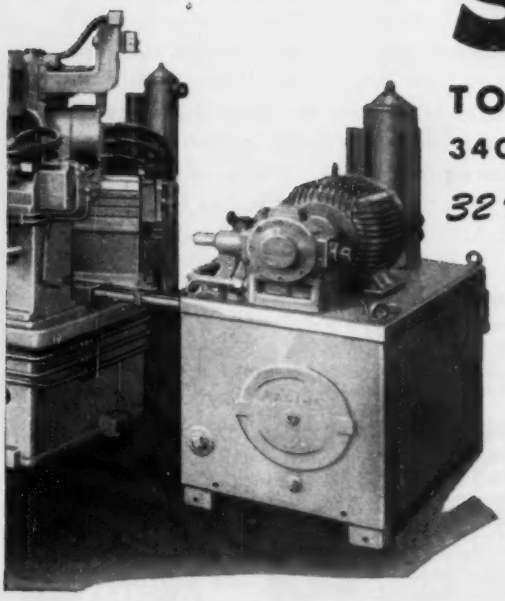
The principle of automation is inherent in the design of this machine which performs, in its continuous 16-station cycle, 25 operations equalling the performance of two or three ordinary machines. The workpiece is a small automotive steering gear ball nut 2½" x 1⅝" x 1⅞". Production is 331 pieces per hour.

Three workpieces are loaded and automatically clamped in each of the 16 fixtures on the 96" index table. A unique feature of the machine is its special heavy-duty cast iron center column 108" high and 48" in diameter. This massive column is necessary to withstand the high vertical thrust loads imposed by six heads mounting 9 spindles each which drill, flat bottom drill and radius chamfer four recirculating ball holes and tap drill and chamfer one hole in the same part face.

The table is also designed to withstand high horizontal thrust loads for core drilling, chamfering and reaming the threaded shaft hole which requires three spindles for each of the seven Snyder heavy-duty way type units.

The machine, one of the largest of its type, weighs 50,000 lbs., requires 288" x 312" floor space and stands 156" high overall.

If you have an automation problem in machining small parts, this type of Snyder machine may be the right answer.

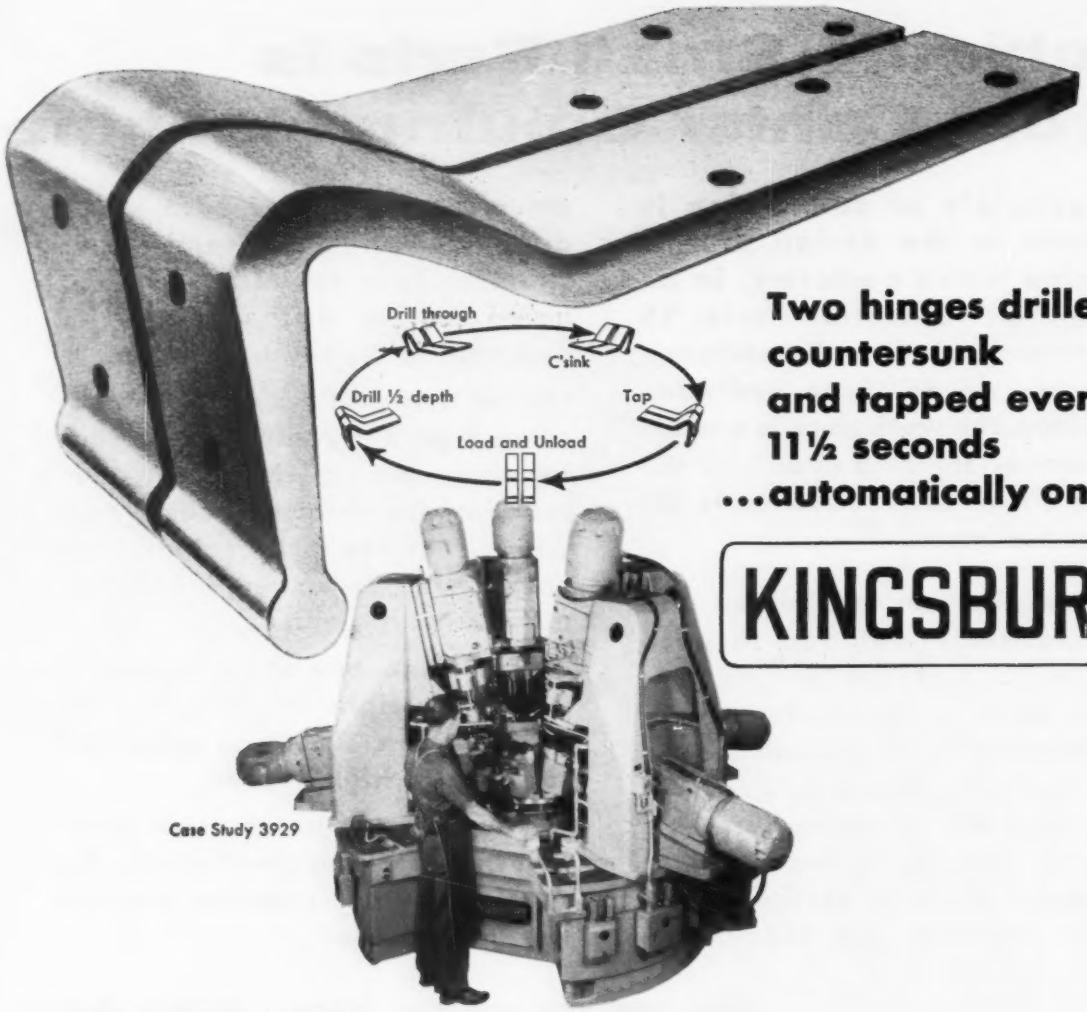


SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

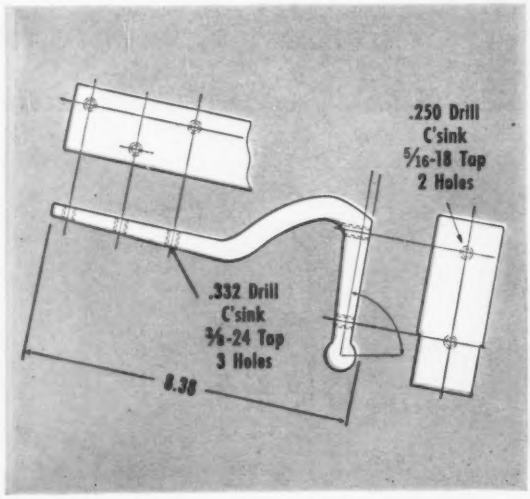
32 Years of Special Machine Tools with Automation



Case Study 3929

Two hinges drilled, countersunk and tapped every 11½ seconds ...automatically on a KINGSBURY

THREE OPERATIONS FROM TWO DIRECTIONS ON THIS FORGED STEEL HINGE ...620 PARTS PER HOUR GROSS



The print shows the angle at which the fixtures hold the work. This angle allows room for four vertical units (three visible in the photo). Each fixture holds two parts. The four vertical units drill half depth, drill through, countersink and tap three holes in each part. Two-step drilling shortens the time cycle and increases the production rate. Four angular units (only three visible in photo) perform similar operations on the two holes. The operator unloads a finished part, loads a rough one and pushes a button to index the table. After the table indexes, all units operate automatically.

All Kingsbury machines are completely tooled and ready to produce. We run test samples and ship them to you for your approval before we ship the machine. For high production drilling and tapping, a Kingsbury is the best machine you can buy. May we talk to you about your jobs?
Kingsbury Machine Tool Corporation, Keene, N. H.

KINGSBURY
INDEXING AUTOMATICS
for high production drilling and tapping

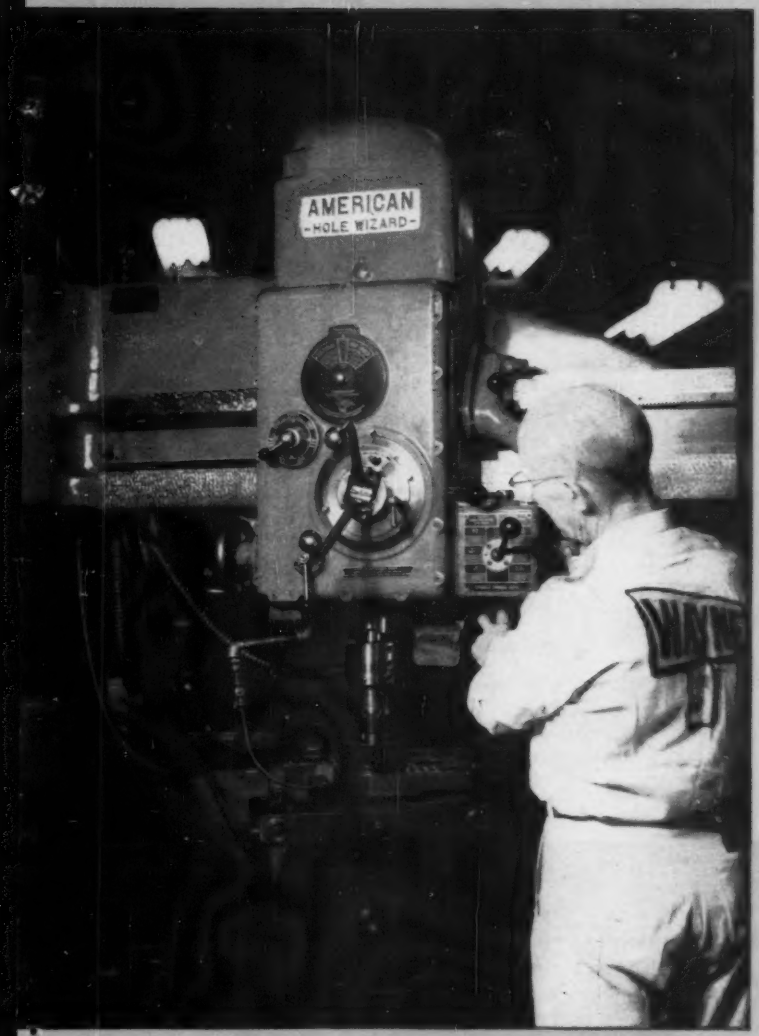
For more information fill in page number on Inquiry Card, on page 257

Costs Reduced
Quality Improved

Wayne Manufacturing Company
Pomona, California
Newark, New Jersey

world's largest producer of

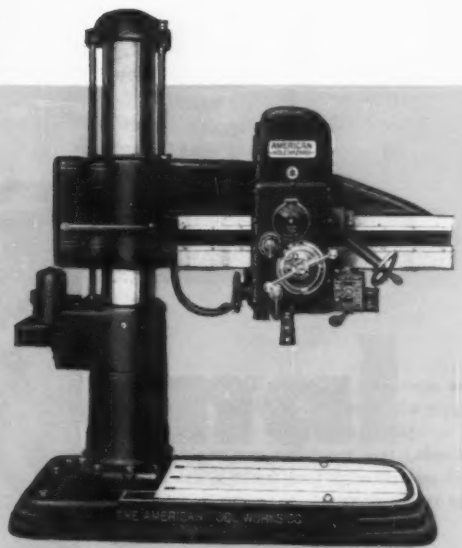
POWER SWEEPERS
for Cities and Industry



. . . cut drilling and boring costs over 50% with an "AMERICAN" Hole Wizard Radial and improved the quality of the work.

Using an assortment of well designed drilling, boring, reaming, tapping, spot-facing and chamfering tools in combination with the "AMERICAN" Hole Wizard's power, rigidity and predominant ease of operation, spectacular savings have been recorded over previous horizontal boring mill methods.

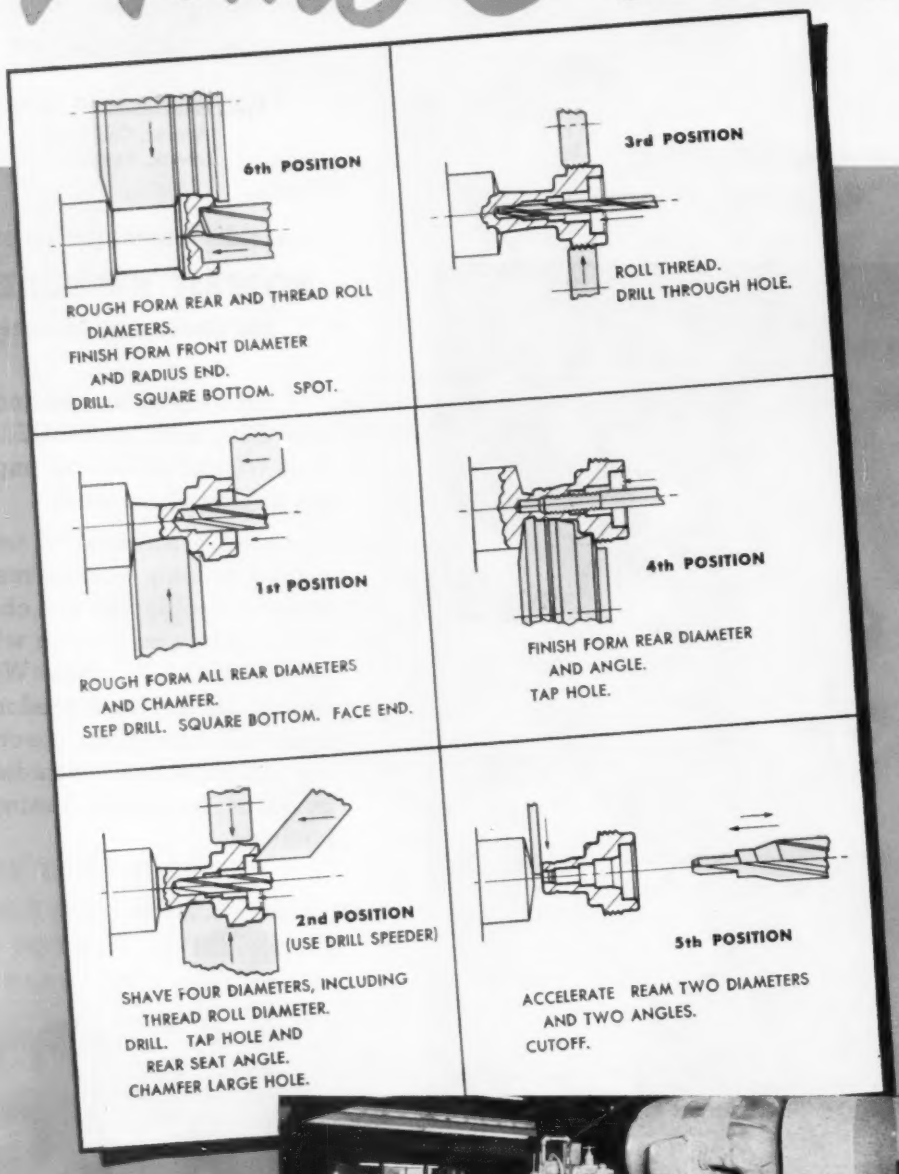
The many production advantages and cost reducing virtues of "AMERICAN" Hole Wizards are disclosed by bulletin No. 325.

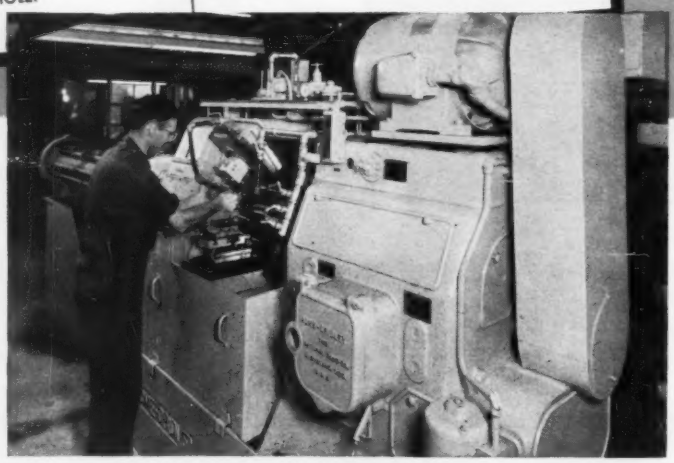


THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Acme-Gridley


6th POSITION
ROUGH FORM REAR AND THREAD ROLL DIAMETERS.
FINISH FORM FRONT DIAMETER AND RADIUS END.
DRILL. SQUARE BOTTOM. SPOT.
3rd POSITION
ROLL THREAD.
DRILL THROUGH HOLE.
1st POSITION
ROUGH FORM ALL REAR DIAMETERS AND CHAMFER.
STEP DRILL. SQUARE BOTTOM. FACE END.
4th POSITION
FINISH FORM REAR DIAMETER AND ANGLE.
TAP HOLE.
2nd POSITION
(USE DRILL SPEEDER)
SHAVE FOUR DIAMETERS, INCLUDING THREAD ROLL DIAMETER.
DRILL. TAP HOLE AND REAR SEAT ANGLE.
CHAMFER LARGE HOLE.
5th POSITION
ACCELERATE REAM TWO DIAMETERS AND TWO ANGLES.
CUTOFF.



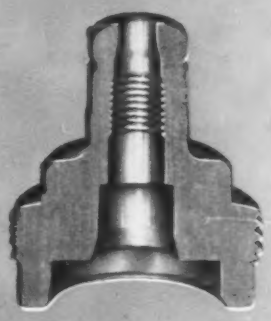
The operator, Clarence Tyler, also is happy with his Acme-Gridley. Tooled to complete one piece every 11¾ seconds, the machine can maintain that speed for as long as 16 hours before it is necessary to regrind tools.

gives NESS, INC. important production bonuses

Purchased primarily to eliminate secondary operations, this Acme-Gridley Six Spindle Bar Automatic has given a good account of itself in many other ways.

Says G. C. Pfrengle, General Manager of NESS, INC., "This 1¼" Acme-Gridley Six Spindle Automatic came into the shop and immediately went into production, without an extended 'get acquainted period'—notwithstanding the fact that we had not run this type of automatic previously. It has been completely satisfactory; we are especially pleased with the tool life and stability of the machine, which has resulted in a minimum of down time. And, since we are able to complete the part without secondary operations, costing is improved."

Owners of Acme-Gridleys will recognize immediately that the *"tool life and stability of the machine,"* about which Mr. Pfrengle comments, is the result of plenty of "beef", properly distributed—a basic design principle of all Acme-Gridleys.



JOB FACTS

PRODUCED BY: Ness, Inc., multiple operation specialists in the production of automatic screw machine products, emphasizing close tolerances.

PART.....Bushing
MATERIAL.....B-1113 Steel
MACHINE TIME.....11¾ Seconds
NUMBER OF OPERATIONS.....14

INDEX... to lower machining costs... with Acme-Gridley CONTROLLED CYCLE

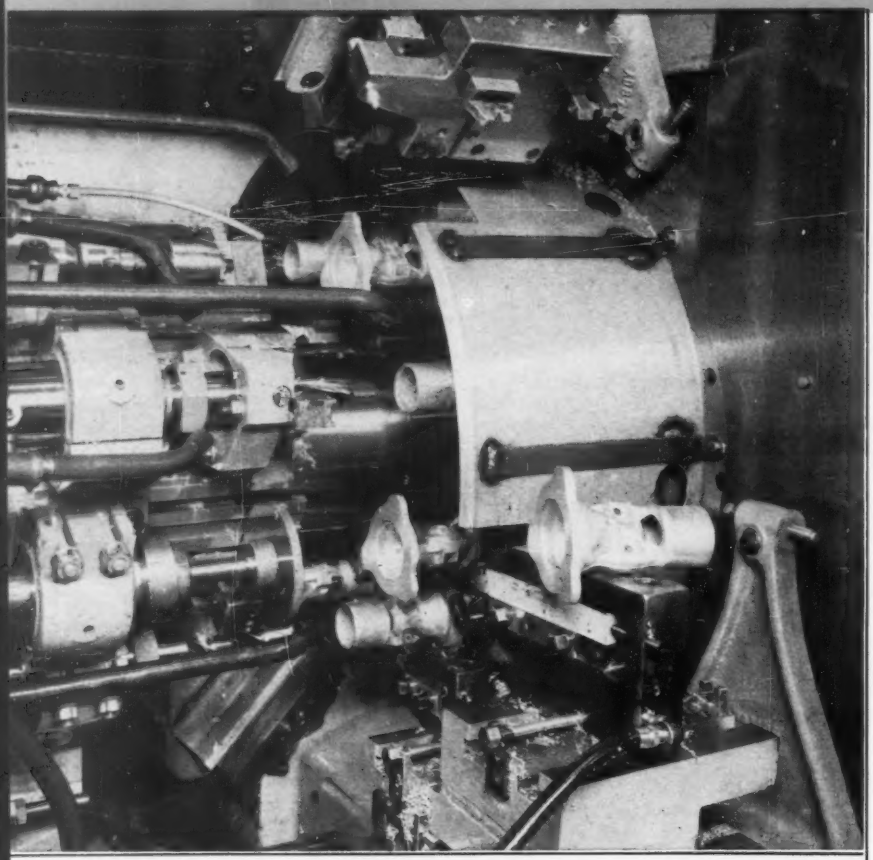
National Acme

THE NATIONAL ACME CO.
179 EAST 131ST STREET
CLEVELAND 8, OHIO

Sales Offices... Newark, N. J.... Detroit, Mich.... Chicago, Ill.

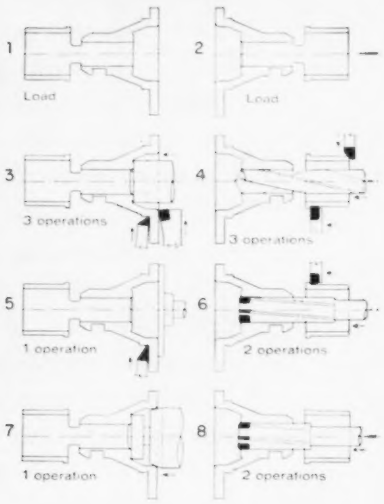
Acme-Gridley

RPA-8 SPINDLE CHUCKER

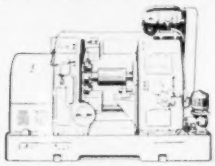


BASKET HUB
ALUMINUM DIE CASTING

Double indexing—both ends completed at one setup on 6" RPA-8 Acme-Gridley Chucking Automatic.



12 operations in 13 seconds



SPEEDS PRODUCTION . . .

eliminates special machine investment

When it became necessary to replace the special machine on which this washing machine basket hub had been produced, the production engineer chose an Acme-Gridley eight spindle chucker. His choice was based on two factors: lower initial investment than that required by the special machine; greater adaptability of the Acme-Gridley with proper tooling to handle many such jobs that otherwise would require special equipment.

Acme-Gridley 8-spindle automatic chucking machines give you maximum production at lowest cost per piece because of greater tooling flexibility, double indexing that permits finishing both ends of the piece at one time, and comprehensive tooling engineering that comes only from COMPLETE LINE experience.

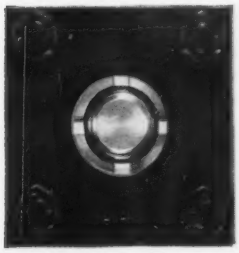
Write today for
Bulletin Nos. CM-44 and CM-51A

INDEX . . . to lower machining costs . . . with *Acme-Gridley* **CONTROLLED CYCLE**

National Acme

THE NATIONAL ACME CO.
179 EAST 131ST STREET
CLEVELAND 8, OHIO

Sales Offices . . . Newark, N. J. . . . Detroit, Mich. . . . Chicago, Ill.



Here are the world's finest power cylinders

...competitively priced!

This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

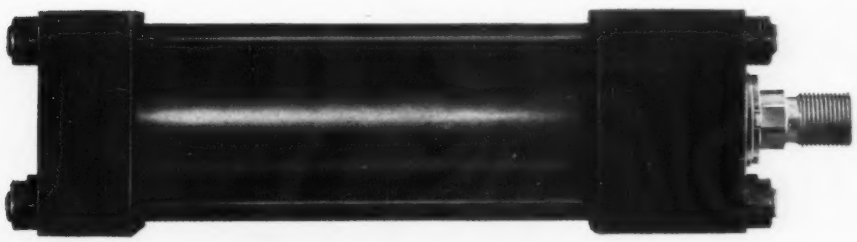
He'll show you design features that other cylinders simply do not have... extra quality workmanship at critical points that pays off in longer life ...accessibility that simplifies their infrequent maintenance. And when he talks price and delivery, you will find these better features cost you no more, can often be delivered sooner.

We think you'll agree that it pays to standardize on Hannifin cylinders.

AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS



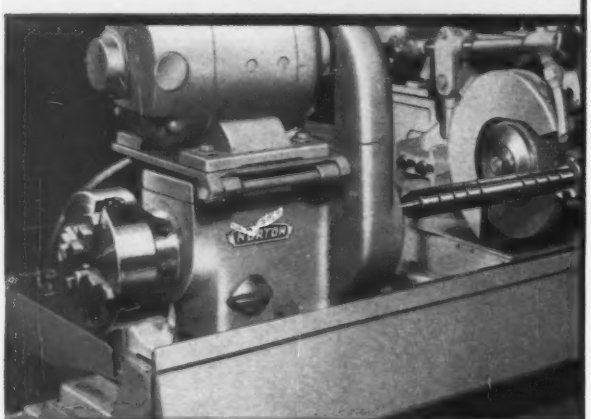
COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Ill.

For more information fill in page number on Inquiry Card, on page 257

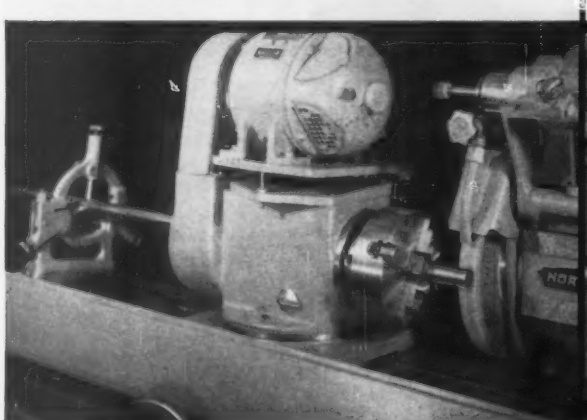
Norton builds extra versatility into universal grinders...

JOB-SPEEDING FEATURES

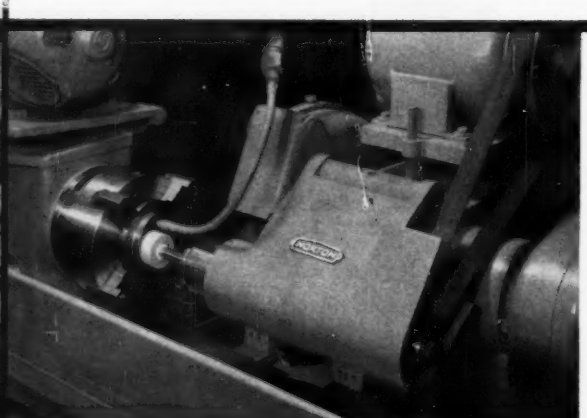


Minimum effort to change from dead center to chucking work. Chuck may remain mounted at back end of headstock while dead-center grinding.

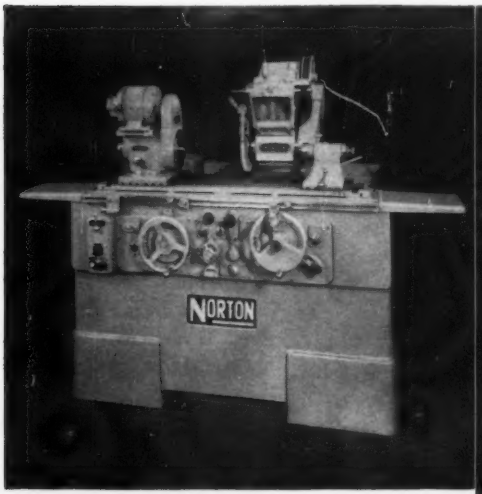
to put extra dollars in your pocket



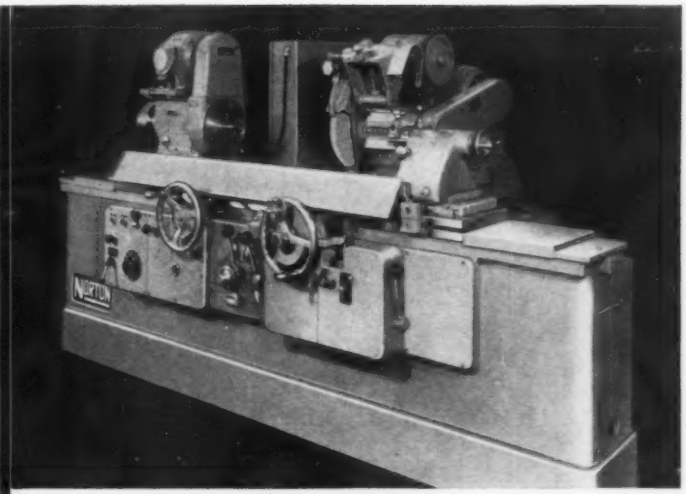
Hollow headstock spindle gives you additional capacity for grinding long bars by passing them clear through and supporting them in grinding position.



Hinged-bracket type internal grinding spindle swings up and out of the way when not in use. This means quicker setups for your I.D. or O.D. grinding.



Norton 10″ universal grinder. Made with 20″ or 24″ nominal lengths between centers. Catalog 170.



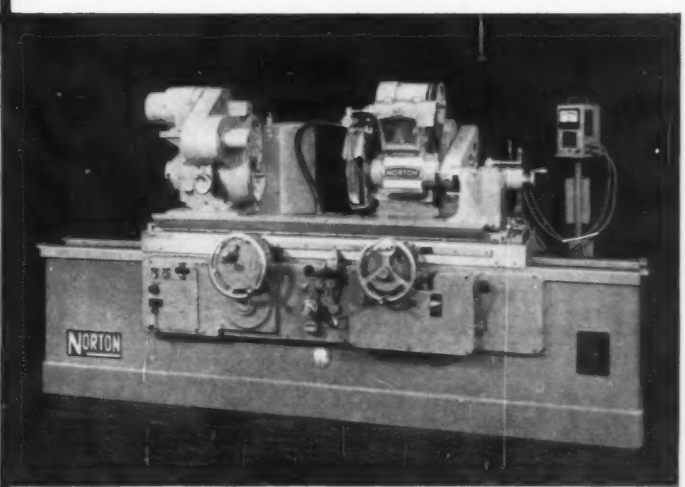
Norton 12″ Type U-4 universal grinder. Made with 36″ or 48″ nominal lengths between centers. Catalog 231.

Many a user rates his Norton universal grinder as a practically "complete grinding department." Why? Because Norton builds extra versatility into its universals for faster external, internal, face, taper and angular wheelside grinding, including many special jobs. Also they're built with many famous job-speeding, cost-cutting features: For example:

Extremely rapid chucking . . . quick change-over to live or dead spindle operation . . . easy work speed changes . . . independent wheel settings that do difficult jobs fast . . . extra capacities on wheel head and headstock . . . precise swivel table alignment with the SWIVALIGN *Dual Electric Indicator, an optional extra.*

Made In The Size You Need

Norton universal grinders are made in 10″, 12″, 14″ and 18″ swing capacities. That means you can get exactly the size to bring you many time-and-money-saving "Touch of Gold" advantages. For complete facts on these high-efficiency machines see your Norton representative or write us direct. And remember: Only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.



Norton 14″ Type U-4 universal grinder. Made with 36″, 48″ or 72″ nominal lengths between centers and also in 18″ swing capacity. SWIVALIGN* Dual Electric Indicator, at right of picture, measures swivel table adjustments and is optional on all Norton universal grinders. Catalog 819.

To Economize, Modernize with NEW

NORTON

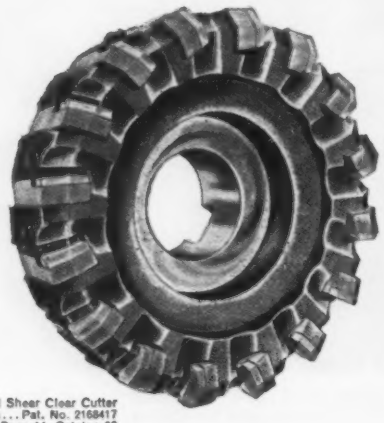
GRINDERS and LAPPERS

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

District Offices: Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries



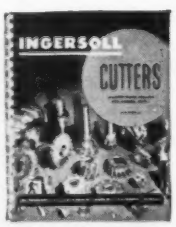
Ingersoll Shear Clear Cutter
27600 series... Pat. No. 2168417
Page 14, Catalog 66

Feed rate increased 2½ to 5 times at Vaughn with this INGERSOLL SHEAR CLEAR® CUTTER

The cutter previously used was nullifying the investment in a new standard, knee-type milling machine. The machine had more power than was being utilized. The feed rate was only 12″ per minute. The change to Ingersoll Shear Clear permitted the Vaughn Machine Company, Cuyahoga Falls, Ohio, to capitalize on its machine investment and obtain the economy and efficiency of increased feed rate. A feed range of 30″ to 60″ per minute, when milling rough forgings and steel castings, is now continuously maintained.

Ingersoll inserted blade cutters are used on all makes of machines for milling and boring a wide range of materials. An Ingersoll Cutter Division representative will be glad to discuss this and other feed rate experiences with you.

Whether you are concerned with feed rates, longer tool life, finish or cutter costs, the new Ingersoll cutter catalog will be a valuable guide. Write Department 66B.



Use this new 82 page guide for selecting the right inserted blade milling and boring cutters for your work. Write for catalog #66, today.

Representative Ingersoll Customers in Diversified Industries

AMERICAN LAUNDRY MACHINE CO.

AMERICAN MACHINE & FOUNDRY CO.

AMERICAN MOTORS CORP.

BRIDGEPORT BRASS COMPANY

BROWN & SHARPE MFG. CO.

CINCINNATI MILLING MACHINE CO.

CLEARING MACHINE CORPORATION

DE LAVAL STEAM TURBINE CO.

DOMINION ENGINEERING WORKS, LTD.

DOUGLAS AIRCRAFT CO., INC.

ELLIOT CO., INC.

FAIRBANKS-MORSE & CO.

A. FINKL & SONS CO.

GENERAL ELECTRIC CO.

INTERNATIONAL BUSINESS MACHINES CORPORATION

INTERNATIONAL HARVESTER CO.

KAISER ALUMINUM & CHEMICAL CORP.

NORTON COMPANY

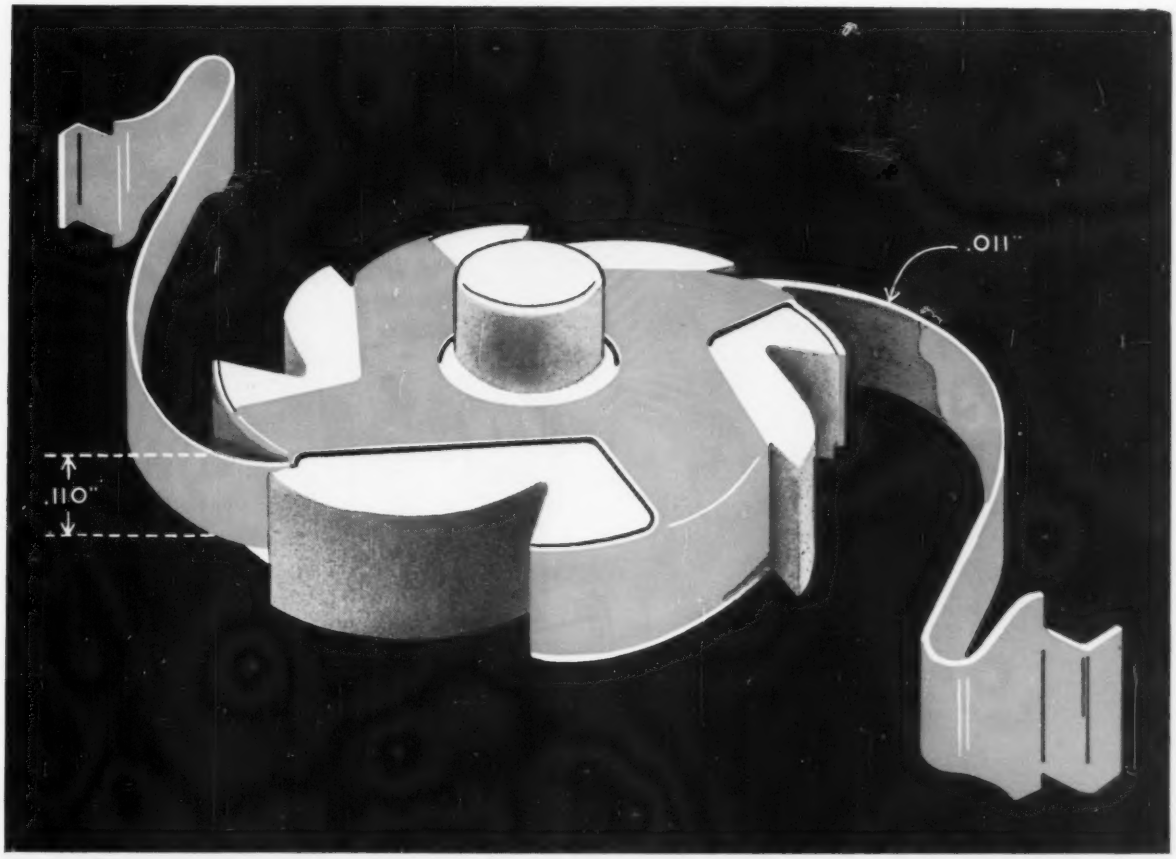
UNITED STATES STEEL CORP.

VAUXHALL

CUTTER DIVISION

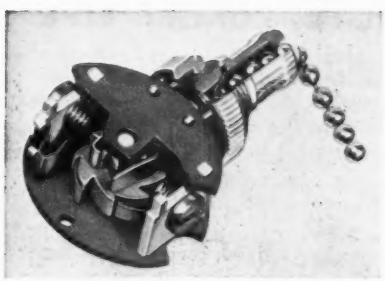
THE INGERSOLL MILLING MACHINE COMPANY

ROCKFORD ILLINOIS



Enlargement showing the contact springs at the "heart" of one model of the Levolier® switch mechanism. Levolier switches are used in industrial and commercial lighting, in heavy-duty industrial sockets, in appliances, fixtures, etc.

The Anaconda alloy tailored for this punishing service actually costs less



Cutaway of Levolier Switch No. 41 shown approximately actual size.

THE PROBLEM: The McGill Manufacturing Company, Inc., Valparaiso, Indiana, was interested in a desirable substitute for a premium copper alloy used in contact springs for their widely known Levolier switch mechanisms. Unexcelled quality had to be maintained with a new alloy that would help hold prices against rising costs. As these switches are designed for long service and heavy-duty industrial service, the spring material has to be tough and durable.

THE SOLUTION: In 1952, McGill discussed the problem of an alternate spring material with a metallurgical engineer from The American Brass Company. After an analysis of the requirements, a special Anaconda alloy was offered—Ambronze-422, rolled to spring temper.

Samples were prepared and tested by McGill and Underwriters' Laboratories. The material performed satisfactorily in standard tests—current carrying capacity, 6 amps at 125 volts d.c.—readily exceeded the requirements of 75,000 cycles, or 150,000 individual operations.

In production, the new Anaconda alloy also performed satisfactorily. It was necessary to make only one minor die-forming change. McGill received a desirable saving in material costs—product quality remained high—and the material was available as needed to maintain production.

FREE TECHNICAL SERVICE: This is another example of the Anaconda technical service available to metal users. Sometimes a new alloy is required—other times a variation of a standard alloy will do the job. The Technical Department of The American Brass Company, through its day-to-day work with a wide variety of metal problems, offers a tremendous breadth of experience, which is at your disposal. See your American Brass Company representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 5664

ANACONDA® COPPER AND COPPER ALLOYS

For more information fill in page number on Inquiry Card, on page 237

...PAY OFF IN HIGH EFFICIENCY GREATER STRENGTH, LONGER LIFE

Where you have a machine drive that requires high horsepower speed reduction under grueling load and shock conditions, specify Philadelphia Continuous Tooth Herringbone Speed Reducers . . . Built to withstand the most severe round-the-clock operation, these Reducers offer you extra service dividends through high efficiency, greater strength, and years of quiet, trouble-free operation.

Herringbone and Helical Gear teeth are precision cut for maximum tooth contact and overlap . . . assure uniformity of torque and freedom from damaging vibration.

Gears and Pinions are arranged symmetrically within rugged, compact housings, which assures equal loads on each shaft bearing, and minimizes the most severe stresses. Fully enclosed, self-contained housings prevent oil leakage . . . no parts such as glands require adjustment . . . more than ample oil reservoir assures cool correct lubrication. Available in single, double and triple reductions covering a range of ratios from 1.75:1 up to 292:1, Philadelphia Herringbone Reducers provide optimum performance at minimum cost.

Send for new 48-page catalog . . . contains complete design and application data on these widely used, highly efficient units.

phillie gear®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS
Virginia Gear & Machine Corp. • Lynchburg, Va.

"Best yet... for Heavy Duty HOLE PUNCHING up to ¼" steel"

"Our CJ Tooling is fast and clean for heavy duty work on sheets, and we're also getting big profit from punching holes in channels, angles etc. That's a tough proposition for the average shop . . . but not for us! With our WALES equipment we cut vees and corner notches at the same time. It really boosts our production."

WALES CJ Units punch unlimited straight line, staggered and scattered patterns . . . round or shaped holes. Die retention design features rapid die change WITHOUT REMOVING UNIT from set-up . . . provides controlled slug ejection. Time saving and money saving. Same units may be used over and over again in other patterns.

SEND FOR BULLETIN NO. 16B

Shows actual job work and complete data of CJ sizes.

WALES MOBILE FIELD UNITS

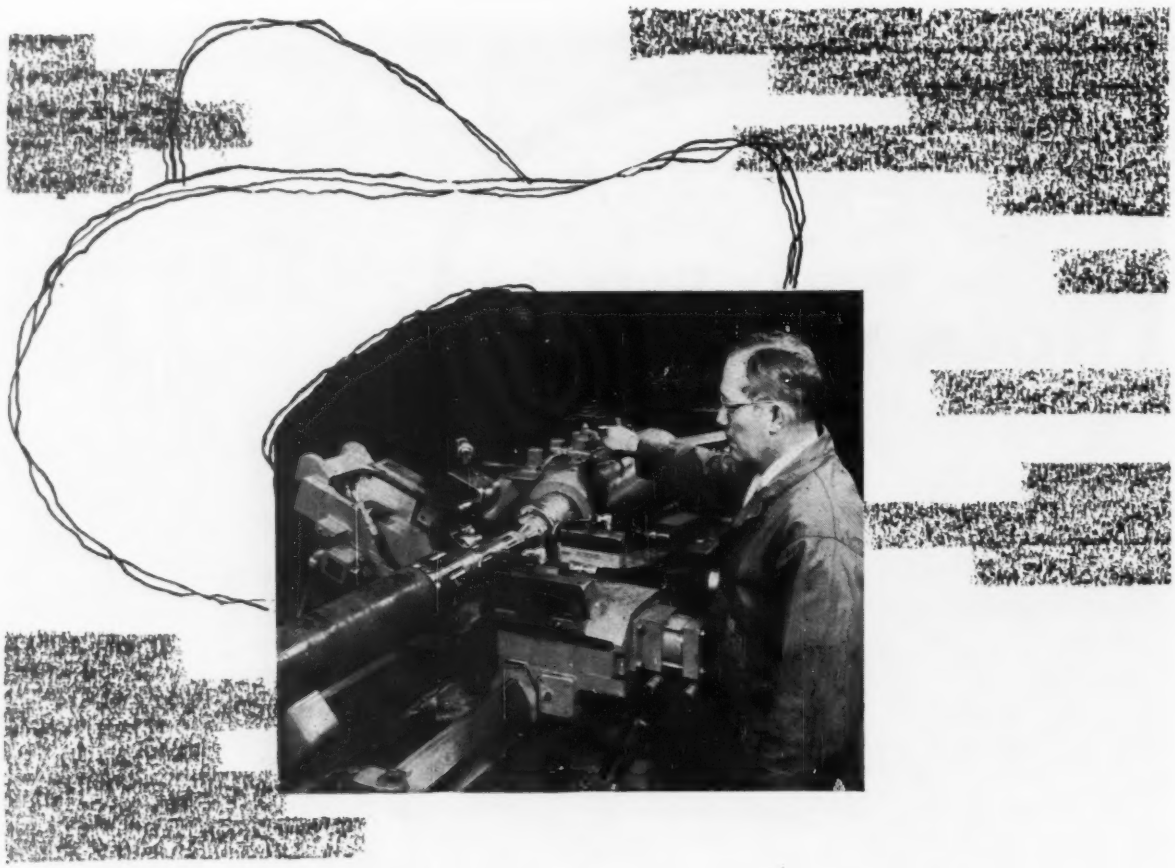
Will demonstrate CJ and other tooling right at your door. Ask for details.

WALES Strippit COMPANY

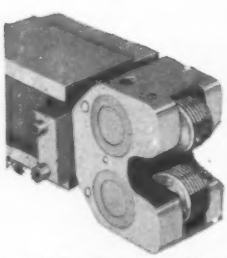
"...the Wales-Way is the PLUS-PROFIT way"

AKRON, NEW YORK

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.



Roll your own *in no time* with a Monarch Mona-Matic!



ON THIS JOB, thread rollers mounted on the hydraulically-operated rear slide perform a very precise thread rolling job *during traverse return* of the front carriage. If that's not strictly "no time," it's certainly "no-cost time"—and who could possibly want more than that?

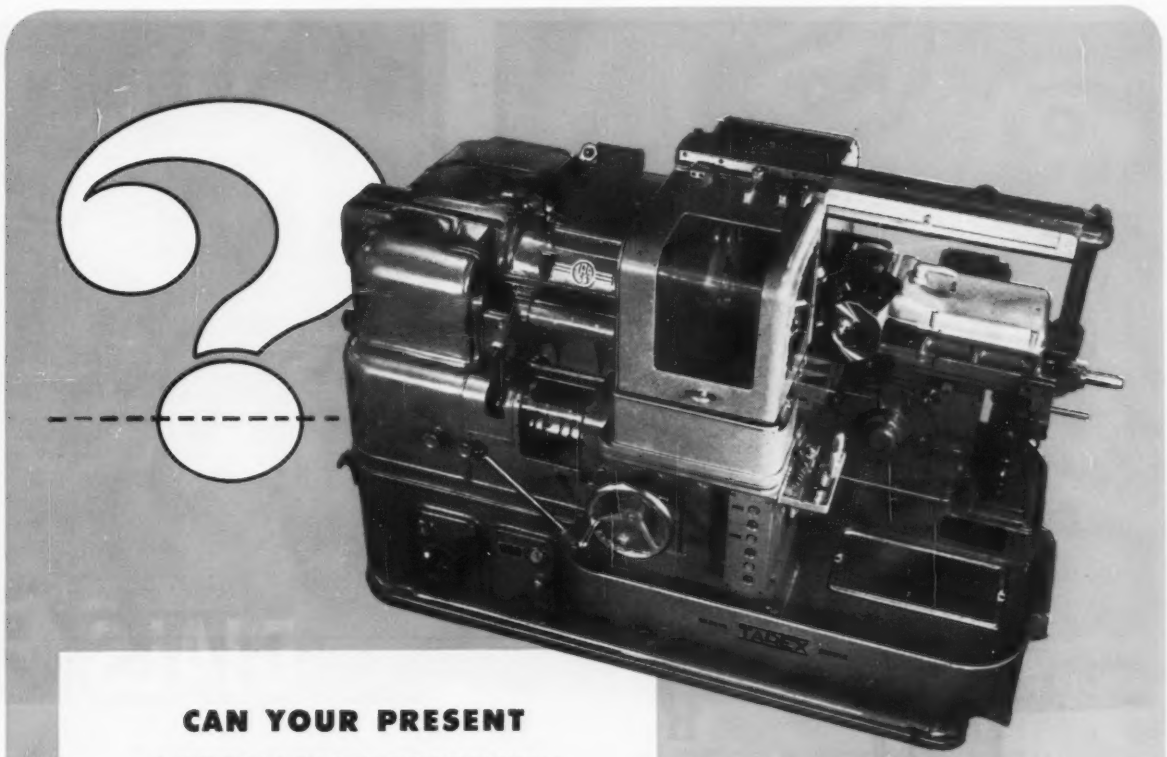
The part is a fabricated trailer axle, about 80" long, identical spindle ends of which are turned and threaded. There are three turned sections on each end with the end diameter threaded at the tag end of the cycle.

Because the axle is fabricated by butt welding the forged, rough turned spindle ends to a piece of seamless steel tubing, an interesting front carriage cycle is employed. During one of the three feed movements, the welding bead is removed by a tool on a hydraulically operated auxiliary slide mounted on the left hand end of the carriage.

And that's only part of the Mona-Matic savings story! Customer used to turn on one machine, thread on another with a die head. Now he does the *whole job—on one machine—faster than just the turning used to take.*

Remember that thread rolling (up to 1½" diameter) is an extra for some users—only one of many that can be yours when you turn the Mona-Matic way. Let us figure a job for you . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

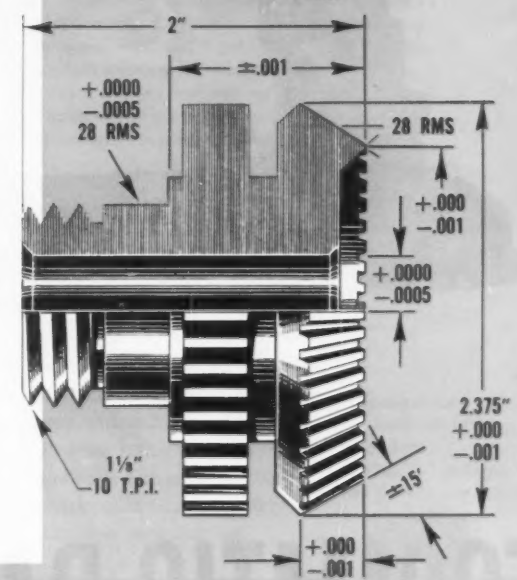
Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES
FOR A GOOD TURN FASTER . . . TURN TO MONARCH



CAN YOUR PRESENT AUTOMATIC EQUIPMENT *make this* BEVEL CLUSTER GEAR *complete* FROM BAR STOCK *in one operation* READY FOR GEAR CUTTING?

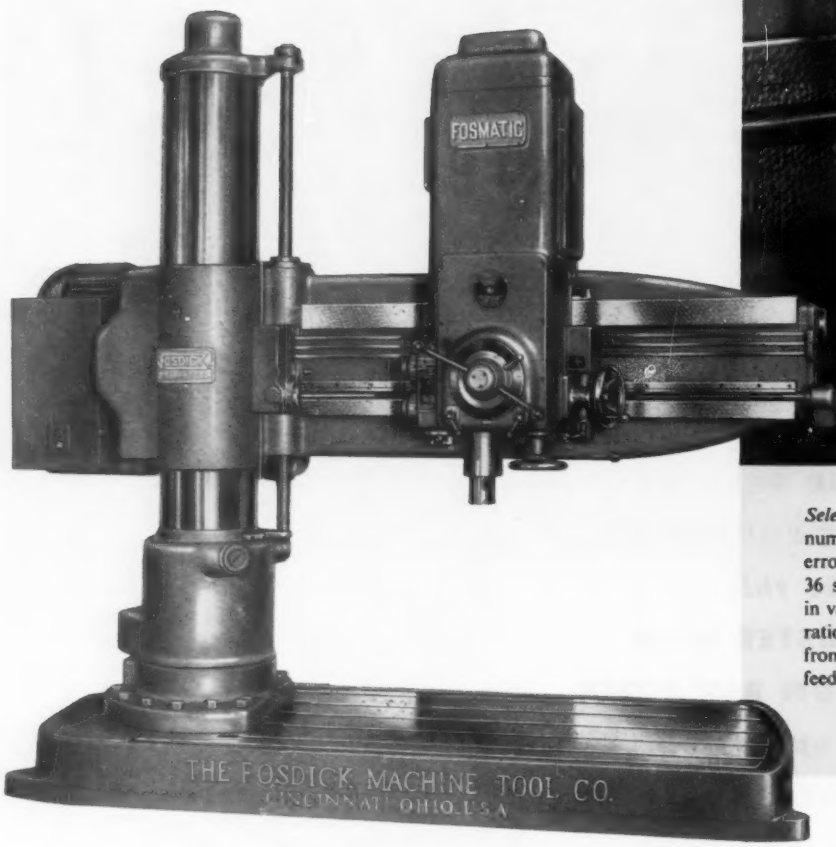
...it can be done on the

TAREX



RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



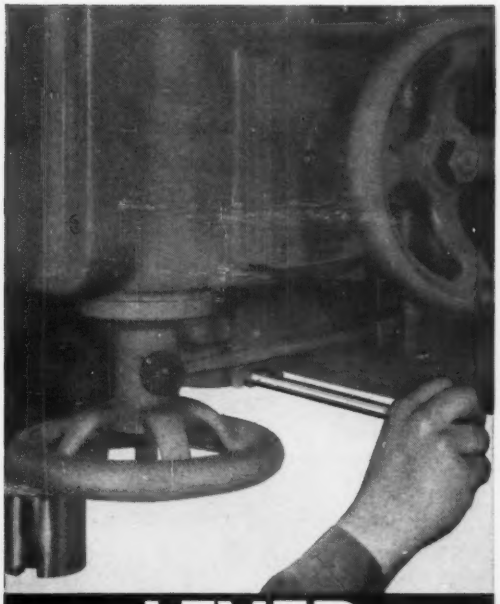
DIALS

Select feeds and speeds with easy-to-read numerical dials. Minimum possibility of error. To save time, select while drilling. 36 spindle speeds, maximum 3000 rpm, in variety of ranges, each with 127.5 to 1 ratio. 18 feeds, including 6 tap leads, from .003″ to .125″. Electronic milling feeds are also offered—from ¾ to 15 ipm.

FOSMATIC RADIAL

SIMPLE CONTROLS

FAST, EASY PRECISION DRILLING



LEVER

Shift, start, stop and reverse with single lever. Shifting to new feeds and speeds is accomplished by raising lever slightly in its neutral position. For faster tapping, reverse spindle speed is up to 40% faster than forward speed.

PUSH BUTTONS

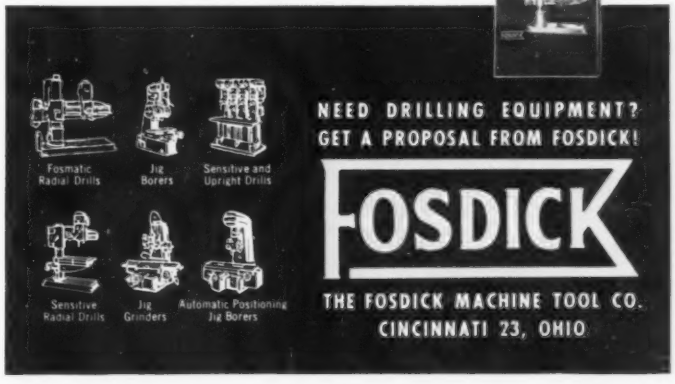
Engage feed by pressing button on either quick-return handle. Feed is disengaged by depth control or by pressing either button again. Feed dial is graduated to full spindle travel, to eliminate resetting for deep holes. Powerful magnetic clutch which engages feed will never need adjusting. Head and column can be clamped automatically when feed is engaged, if desired. They are unclamped by independent levers.

Fast, rigid, precise, easy to run—that's what today's machine shop demands in a radial. And that's what makes the Fosmatic outstanding among radial drills. The simple controls shown here save valuable seconds of operator's time, with each hole drilled. Other convenient controls at the head—single lever to raise and lower arm (hydraulic clamp interlocked) and traverse head; hydraulic column clamp; hand feed and traverse to head; tool ejector eliminates need for tang driver.

The new boring-type spindle is of heavy section with bearings placed far apart for extreme rigidity; it can be used for boring, milling and the heaviest drilling. A new and unique counterbalance produces equal tension on the spindle whether it is extended or close to the head. Case-hardened gears are ground on the finest equipment available. They run on ground splined shafts which are mounted in ball bearings. Lubrication is automatic.

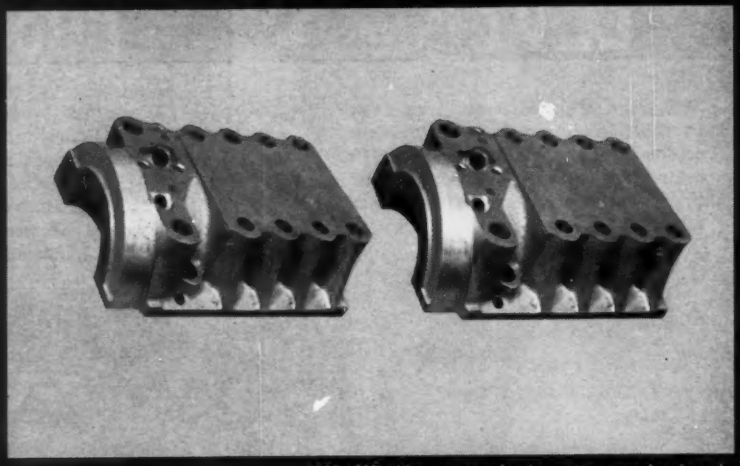
Our new arm is the strongest in the business. It has a double box section with very heavy walls; ways have been widened considerably. The head is mounted on roller bearings on hardened and ground ways with an additional roller support in back of the arm. Safety nut is hydraulic. Column is superfinished.

Standard sizes available with 4' to 8' arms, 13" to 19" columns. Write for Catalog RD-A.



THREE NEW DEVELOPMENTS
Increase Production

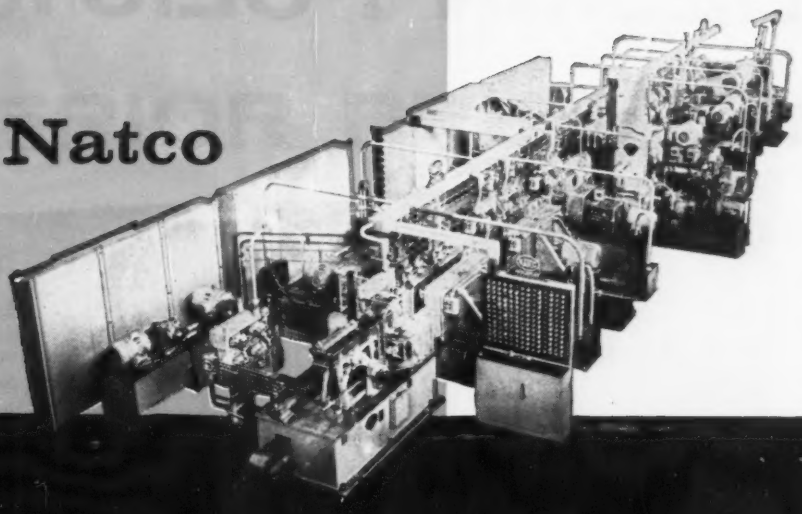
2-at-a-time processing



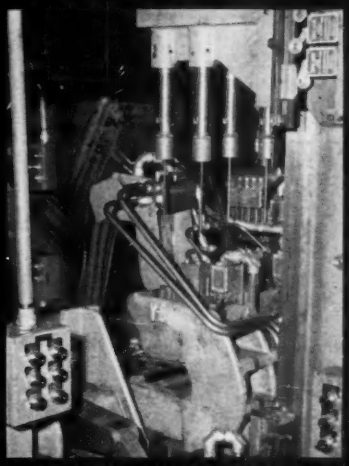
300 HP Natco greatly increases production by processing two complete sets of bearing caps at once.

Bearing caps—240 *sets* per hour—six times the production rate of the machine replaced! This new Natco processes two complete sets at once. It loads surface-broached castings automatically, performs 80 machining operations, places matched sets of finished bearing caps on the assembly conveyor. In addition to broaching and sawing, this 300 HP, 27-station Natco, drills, reams taps, turns, mills, probes and faces.

help this Natco 600%

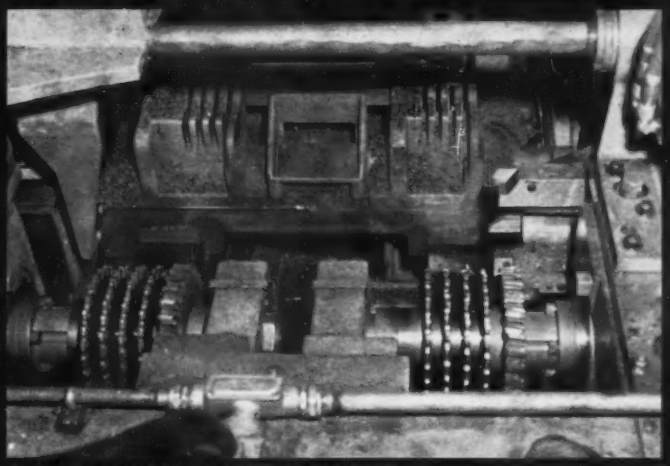


Unique Broaching Station



Fully automatic broaching station eliminates need for withdrawing broaching tools after cut. Broaching tools are pulled completely through hole, removing .030" stock.

New Rigid Saw Station



80 HP sawing station cuts two castings into complete sets of 5 caps each. All surfaces parallel within .0015". Fixture feeds castings into stationary mounted saws, providing rigidity for accurate 14 ipm cutting.

Whatever your high production problem, our engineers will work closely with your people to develop exactly the method and the machine to do your job best. Besides special way-type, index and transfer machines, Natco also builds multiple drilling, boring, facing and tapping machines. Call your nearest Natco office in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles. Distributors in other cities.

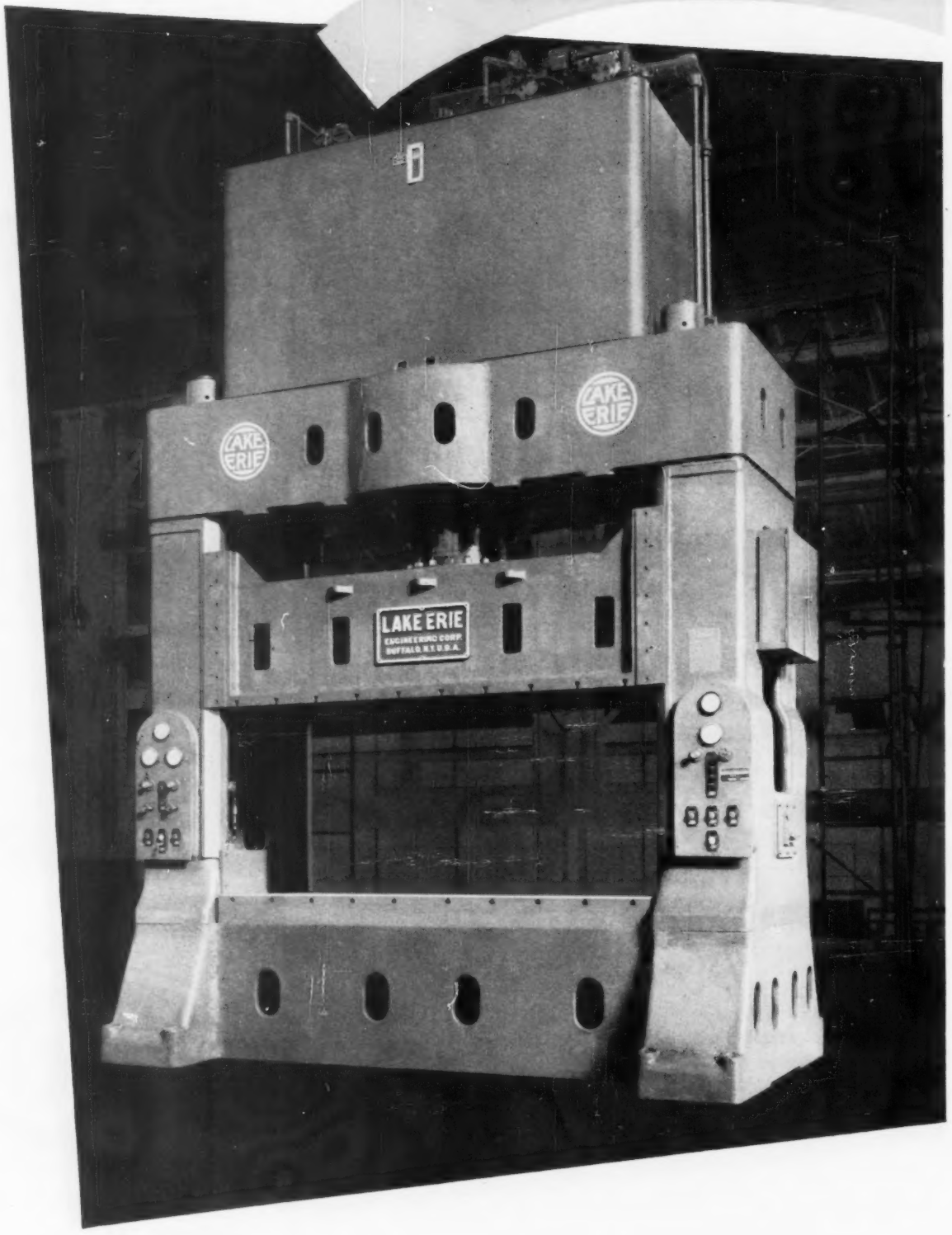
Partners in Production

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC. *Richmond, Ind.*

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan

DESIGN POLICY IS THE



KEY TO

SUPERIOR PRESSES

FORGED STEEL CYLINDERS... *eliminate possible failure of integrally cast cylinders.*

HEAVIER SECTIONS... *mean lower stresses.*

LAPPED CYLINDERS AND PISTONS... *insures precision fit.*

QUICK-SET STROKE CONTROLS... *save time on set-ups.*

UNUSUALLY RUGGED SIDE HOUSINGS... *increase frame rigidity.*

FAIL-SAFE DEVICES... *in electric and hydraulic circuits.*

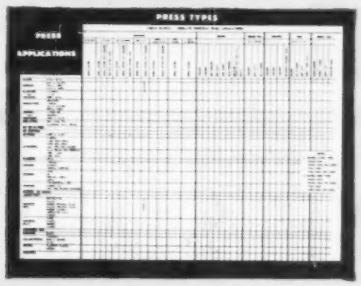
SIMPLIFIED ELECTRICAL SYSTEM... *designed for maximum safety and ease of maintenance.*

BRONZE USED EXTENSIVELY... *bronze throat bushings provide better guiding.*

... *bronze piston heads, gland bushings, and pre-fill valve disc prevent scoring.*

LAKE ERIE BUILDS THEM BETTER... Mechanically, electrically, and hydraulically, Lake Erie presses bring you the greatest number of superior features. That's why Lake Erie press users almost always return to us for additional presses. They know from experience that Lake Erie incorporates many "special" features as "standard"... features which seldom if ever form a part of customer specifications. They know that these features mean longer press life, minimum maintenance, maximum productivity. Next time, call on Lake Erie.

SEND FOR HANDY BUYER'S GUIDE



LAKE ERIE HYDRAULIC PRESSES

EXTRUSION PRESSES • DIE CASTING MACHINES
ROLLING MILL AUXILIARY EQUIPMENT

LAKE ERIE ENGINEERING CORP. *General Offices and Plant, 470 Woodward Ave., Buffalo 17, N. Y.*
District Offices in New York, Chicago, Detroit, Pittsburgh
Representatives in Other U. S. Cities and Foreign Countries

LAKE ERIE®

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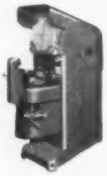
DROODLES

by ROGER PRICE

Bench Model BC-7D

Floor Model FC-30



Floor Model FC-14

Table Model TC-14
(Vertical Inspection)

"T-SQUARE FOR WOOZY DRAFTSMAN"

My designing uncle, Claude, invented this while working for the Biggs Chest-Wig Corp., makers of "Thorax-Thickets." The idea hit him during the annual Company Party. Unk, a fast man with a grape, was in rare form. He had just defenestrated the Accounts Receivable ledgers, and was launching into his famed take-off on Old Man Biggs, when the latter appeared. During the ensuing conversation, Claude bent his T-square over the Biggs cranium, and mankind was enriched by a new invention. Since then, C. has gone on to bigger and better things. He now owns a distillery, making "Tipple-Tot," the children's whiskey. A grand idea . . . wish I'd thought of it first!

Another thing I should have thought of first is the Optical Comparator, made by my friends, Jones & Lamson. The J&L O.C., as I familiarly call it, is a marvelously versatile instrument that is used for measuring and inspecting all sorts of parts and objects of various sizes and shapes. It is speedy and accurate (to .0001") and cuts inspection costs to the bone. The J&L Comparator is equally suited for both production-line and job-shop work, and it performs inspections that just aren't possible by any other method. Get the full details . . . send this coupon *today!*

JONES & LAMSON OPTICAL COMPARATORS *On the Job...*

A customer writes: "The J&L Optical Comparator has enabled us to reduce costly man-hours in inspection time. We are also able to accurately inspect work that previously would have been impractical. A typical case: We had a 1,840,000 piece job requiring accurately drilled .043 dia. holes ¾" deep in 1020 steel. Drill "breakage" was excessive and hole straightness difficult until the Comparator enabled us to easily inspect all drills for precisely ground points and .0005 per inch straightness."

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 512 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name _____ title _____

company _____

street _____

city _____ zone _____ state _____

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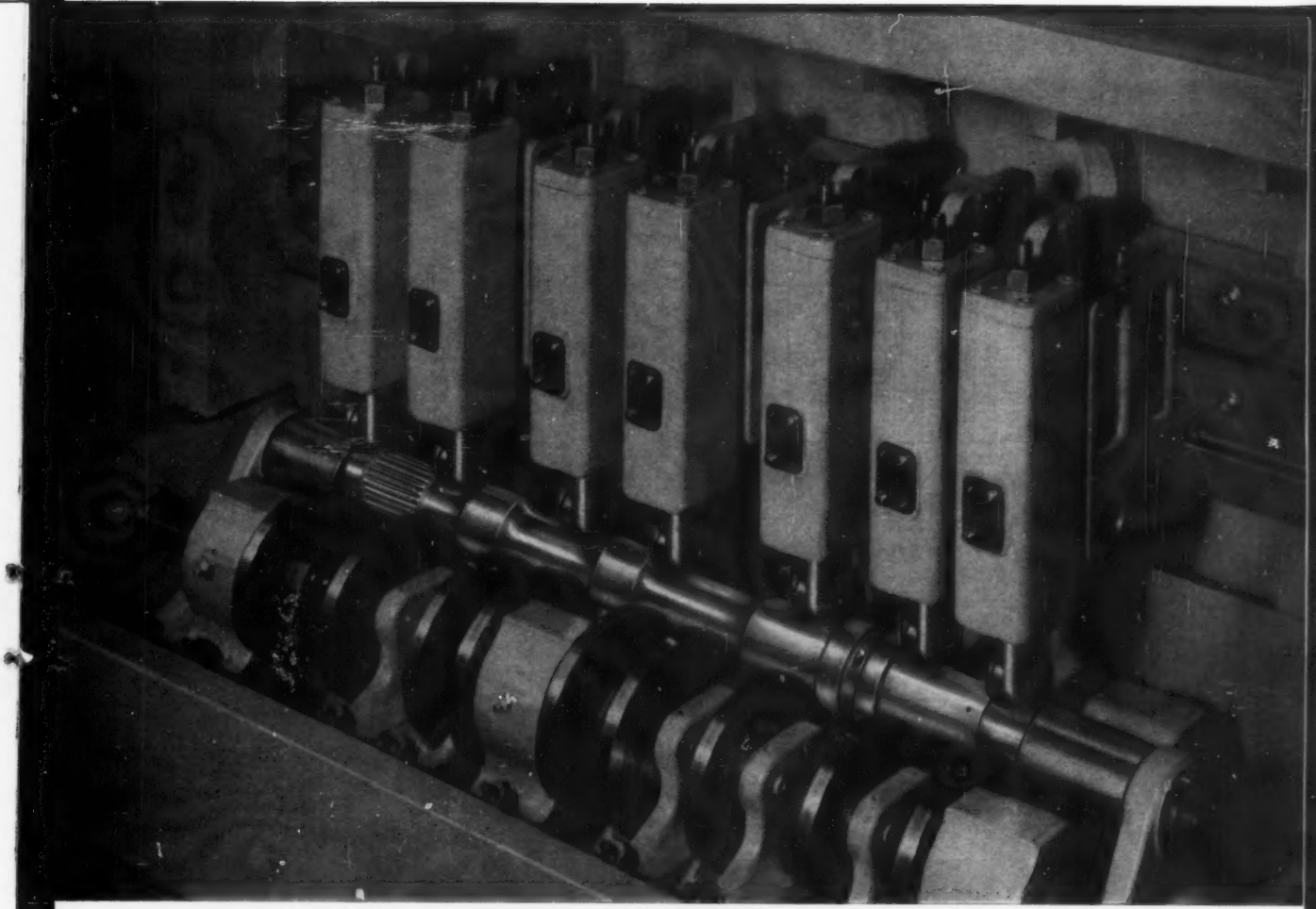


How to eliminate *your* shaft distortion problems

Distortion during hardening is a major production problem.

The Gleason No. 140 Rolling Quench Machine corrects this difficulty, because the quenching and straightening operations are performed at the same time. Because cold straightening is eliminated, valuable production time and expense are saved, and the quenched parts have less residual stress.

Shafts cannot distort because they are rolled under pressure throughout the quenching operation. The operator puts the hot part on the lower rollers and starts the machine. From there on, the quenching operation is automatic. Rolling speed, pressure, and oil flow are pre-set to suit the work that is being quenched.

The automatic quenching cycle saves operator time, and gives *uniform* results for all parts quenched. The pre-set metallurgically correct oil flow gives uniform hardness.

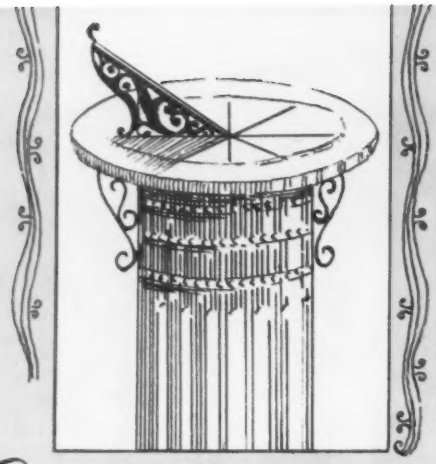
The Gleason No. 140 Rolling Quench Machine is equally suited for small or large quantities. It accommodates shafts $\frac{9}{16}$" to 4" in diameter, 6" to 40" in length, with integral cams or shoulders up to 8" diameter. Tooling can be arranged to hold parts on diameters or centers. Unusual shapes can be handled with additional tooling. Write for further information.

The Gleason No. 140 Rolling Quench Machine also handles multiple quenching of short shafts.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.



Great in its day...

BUT
WOULDN'T YOU RATHER HAVE THE LATEST TECHNICAL ADVANCE?

Heller "Job Tempered" Flat Ground Die Steel

cuts tool making costs 4 ways:

A great new addition to Heller's famous tool line — "Job Tempered" Flat Ground Die Steel — offers solid, cost-cutting advantages to users in four specific ways:

1. **Over 1300 standard stock sizes available** provide the right size for the job — minimum waste in cutting to size — maximum utilization of each piece.

2. **Requires no pre-finishing.** Tool patterns may be laid out directly on its super-smooth 25-35 micro-inch surface.

3. **Easy to machine.** Spheroidize annealed structure of this high grade alloy steel saves time in making the actual tool.

4. **Easy to heat-treat.** Wide hardening ranges make heat treating non-critical. Simple instructions on every package show how to "Job Temper" the tool to get maximum service life and performance on the job.

You get extra assurance that "Job Tempered" Die Steel is *right* because the analysis has been checked and recommended by leading consulting metallurgists. All these advantages add up to real cost-savings in making tools . . . and maximum tool performance under the toughest service conditions.

wide range of standard and stock sizes available in oil hardening and air hardening types

	Oil Hardening	*Air Hardening*
Lengths	18" and 36"	36"
Thicknesses	3/64" to 15/16"	1/8" to 2"
Widths	1/2" to 14" depending on length and thickness	1" to 10"

Stock squares also available.

useful, convenient protective packaging

All sizes are individually packaged, fully protected from rusting and scratching. Analysis, heat treating instructions and dimensions are clearly indicated on every package.

GET THIS HANDY SELECTION CHART!

Shows at a glance the complete range of standard and stock sizes and stock squares of Heller "Job Tempered" Die Steel available from your Heller Distributor.

HANG IT ON YOUR WALL FOR QUICK, EASY REFERENCE.

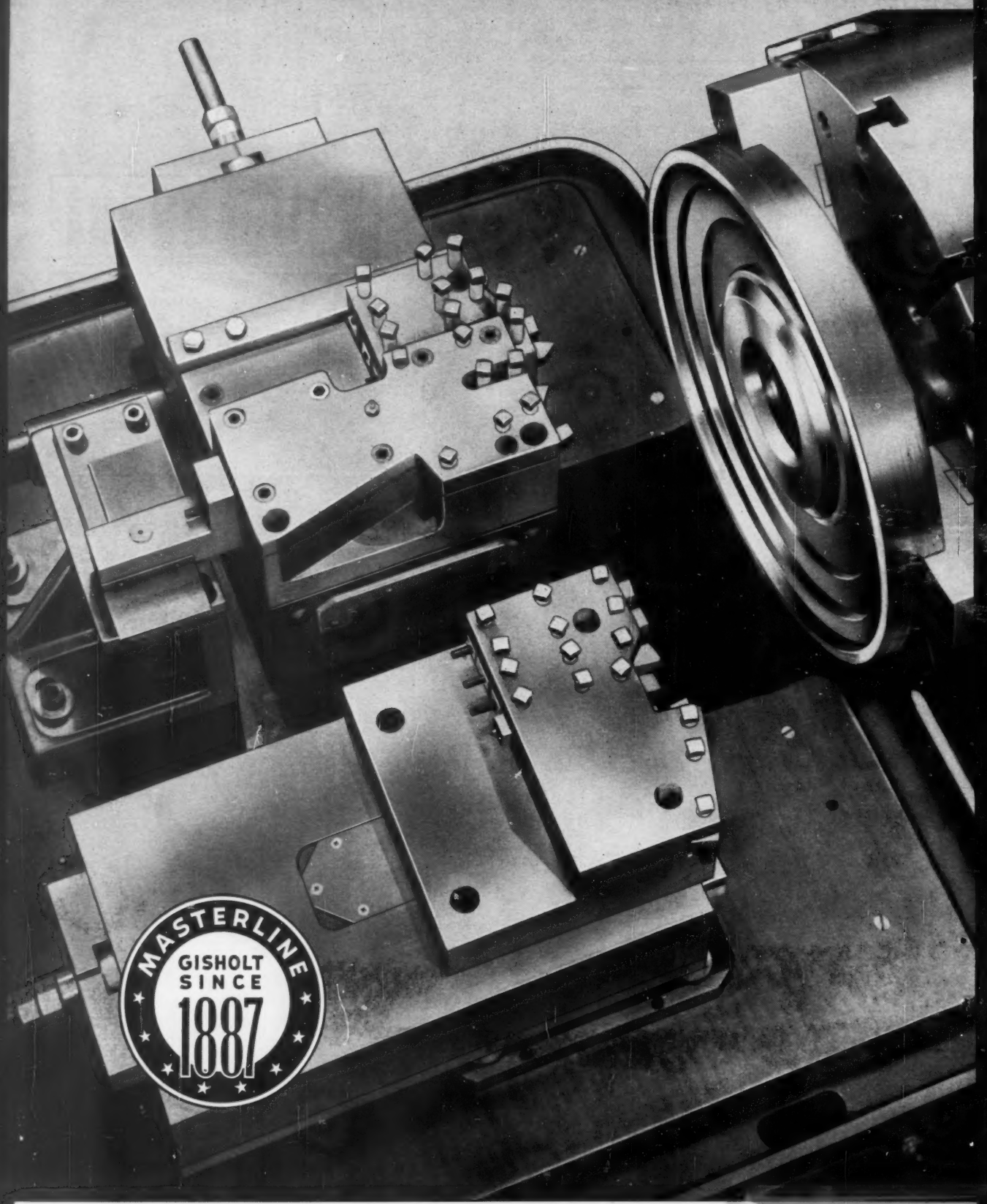
HELLER TOOL CO. SINCE 1830

Heller nucut

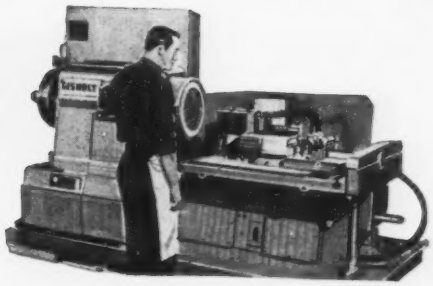
HELLER TOOL CO. *America's Oldest File Manufacturer*
Newcomerstown, Ohio A subsidiary of Simonds Saw and Steel Co.

This New GISHOLT MASTERLINE

SIMPLIMATIC AUTOMATIC LATHE may save you



the cost of a special machine



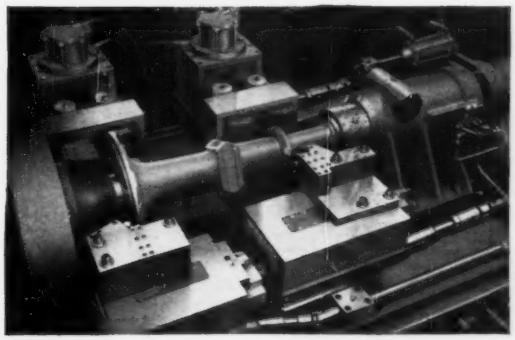
HERE'S WHY: the machine itself—headstock, bed, extra wide platen table—is *standard!*

Yet with the new Gisholt MASTERLINE Simplimatic Automatic Lathe, you have ample space for an *infinite* number of slide and tool arrangements. You can use front, center, rear and auxiliary slides—all moving at different feed rates—carrying enough tools to machine a maximum number of surfaces in a single chucking. All slides are easily mounted at correct angle to the work—keeping tool overhang to absolute minimum for increased rigidity and increased accuracy. And with the Simplimatic's table feed, tools can engage with the work or perform additional machining operations before actual slide movements begin.

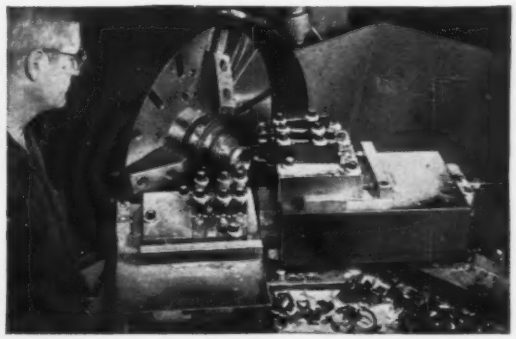
Because the Gisholt Simplimatic is a standard machine, it is *easy* to set up, operate and maintain. In many cases, the automatic cycle frees the operator to handle additional units or perform other work. And the basic design is readily adapted for work-handling devices, which even further simplify the operator's job and speed production!

Ask your Gisholt Representative to show you how efficiently the Simplimatic can handle your problem parts—using a simple, standard machine transformed by addition of standard tool slides, tool blocks and chucking equipment—performing *special* machine functions at *standard* machine prices! Call him today for full information on the Simplimatic!

Simplimatic setup for machining both ends of tractor rear axle housings in one chucking. Four tool slides are used, two at the front and two at the rear of the platen table. Machining includes turning and chamfering, forming and straddle-facing, with tool relief provided for facing tools on the rear tool blocks.



Six different sizes of tough steel oil well cutter bits are handled with ease and efficiency by this tooling setup. All slides and tools are placed at correct angle to the work. Tools are mounted on riser plates, permitting pre-setting for quick change-over and adjustment. Rigid support eliminates chatter on heavy forming cuts.



READY NOW! Write today for new Catalog 1159-A on Gisholt MASTERLINE Simplimatic Automatic Lathe. Fully illustrated—shows 31 typical jobs.

GISHOLT

GISHOLT MACHINE COMPANY

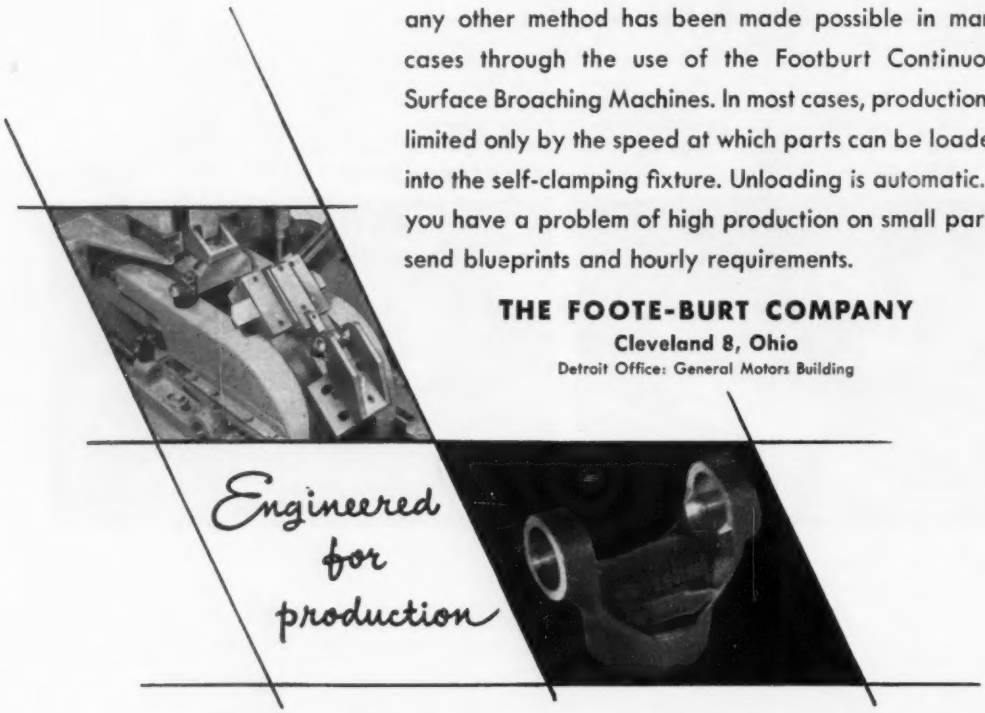
Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

To cut machining costs, machine faster with **continuous broaching**

■ Higher machining production than ever achieved by any other method has been made possible in many cases through the use of the Footburt Continuous Surface Broaching Machines. In most cases, production is limited only by the speed at which parts can be loaded into the self-clamping fixture. Unloading is automatic. If you have a problem of high production on small parts, send blueprints and hourly requirements.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building



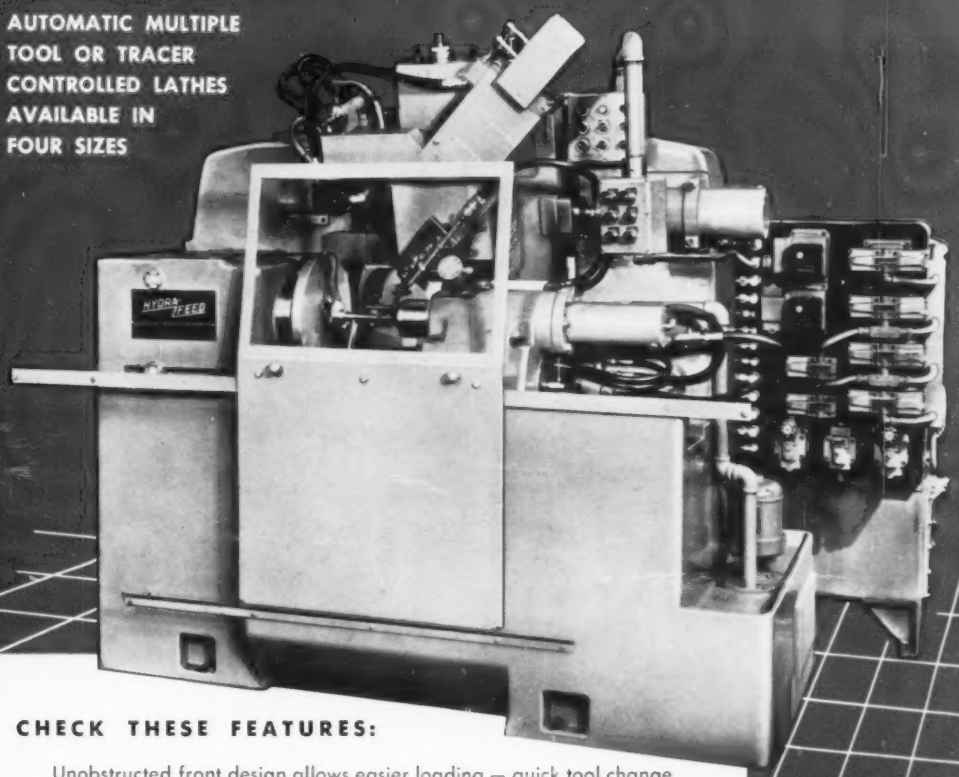
FOOTBURT

PIONEERS IN SURFACE BROACHING

Buy BULLARD HYDRA-FEED

To Get The Best In Production Lathes

AUTOMATIC MULTIPLE TOOL OR TRACER CONTROLLED LATHES AVAILABLE IN FOUR SIZES



CHECK THESE FEATURES:

Unobstructed front design allows easier loading — quick tool change.

Massive strength and rigidity with extra power to take full advantage of maximum feeds and speeds.

Hydraulically operated slides may be set to automatically perform any combination or sequence of operations.

For complete details send coupon for catalog *TODAY!*

THE BULLARD COMPANY
286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT

Please send me a copy of the

NEW BULLARD HYDRA-FEED LATHE CATALOG

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COMPANY _____ POSITION _____

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CITY _____ ZONE _____ STATE _____

from one hour to one minute...

HELIARC Cutting Whizzes Through Aluminum

One of the first aluminum fabricators to use LINDE's new HELIARC cutting process reveals savings of more than 95 per cent over conventional chipping methods—jobs normally requiring 1 and 5 hours to complete are whisked through in only 1 and 4½ minutes respectively. Graver Tank and Manufacturing Company reports beveling, grooving, shaping, and cutting are all performed on ⅝-in. thick, 52S aluminum plate at substantial time, space, and cost savings.

Incredible, but true: HELIARC cutting can attain speeds as high as 600 inches per minute, and cut aluminum in thicknesses up to 1½ inches. No special skill is required. A certified welder can do excellent cutting jobs after less than one hour of instruction.

Get the full story on revolutionary new HELIARC cutting. Call your LINDE representative, or write for free illustrated literature, Form 50,095.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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Division of Union Carbide Canada Limited, Toronto

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Linde
Trade-Mark

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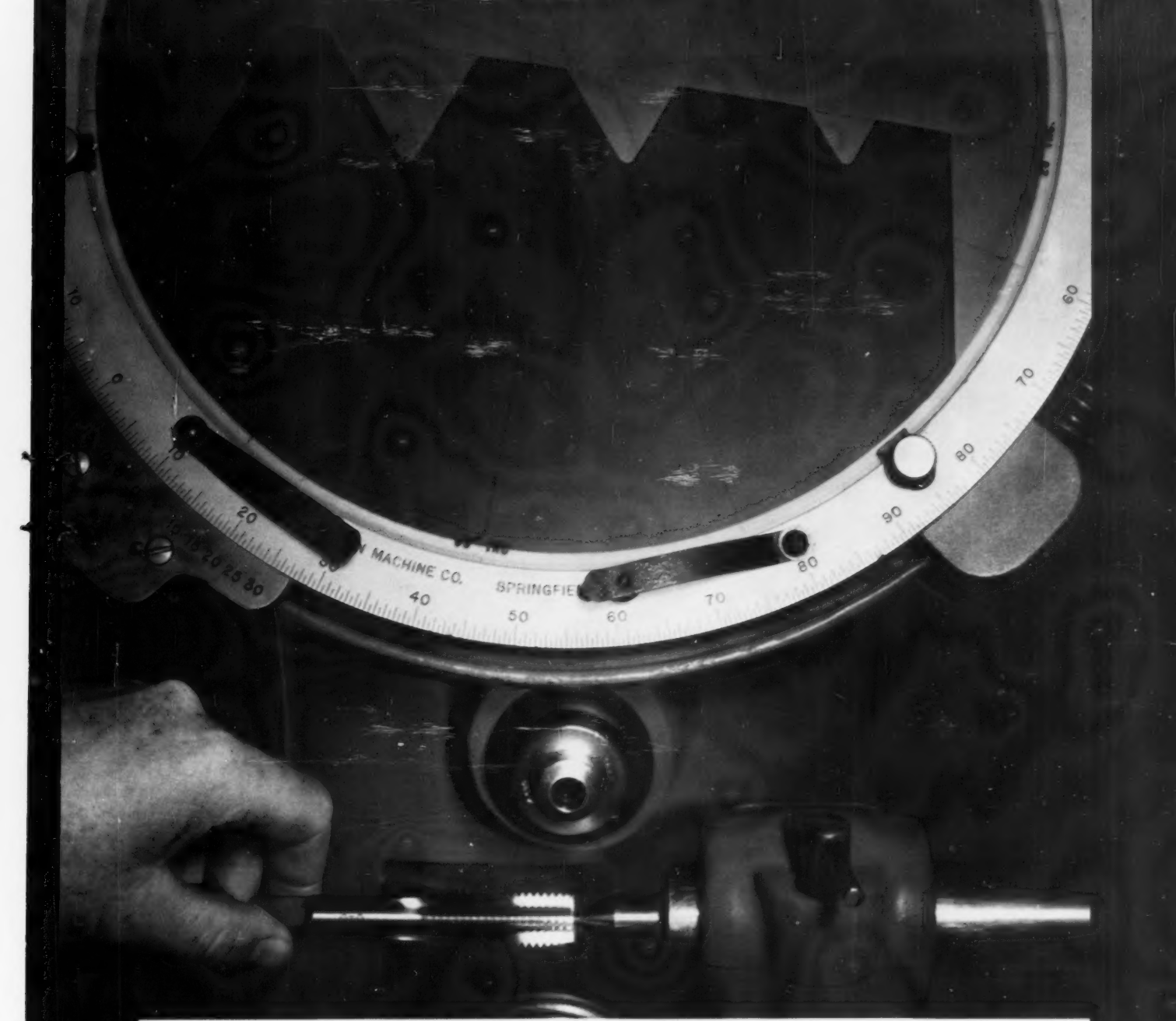


Chamfer "run out" in a tap is the deviation in chamfered thread height from one land to another in relation to the axis. If present to an appreciable degree, this eccentric condition affects hole size and may cause bell mouth in threaded holes and rapid wear on the cutting teeth of taps.

Inspection of chamfers, enormously magnified, is another of the careful quality control checks at "Greenfield" which assure that the taps you buy are as free from faults as constant vigilance can make them.

IF IT CAN BE MEASURED **GREENFIELD** *MEASURES IT*

GREENFIELD TAP and DIE CORP.
GREENFIELD, MASS.

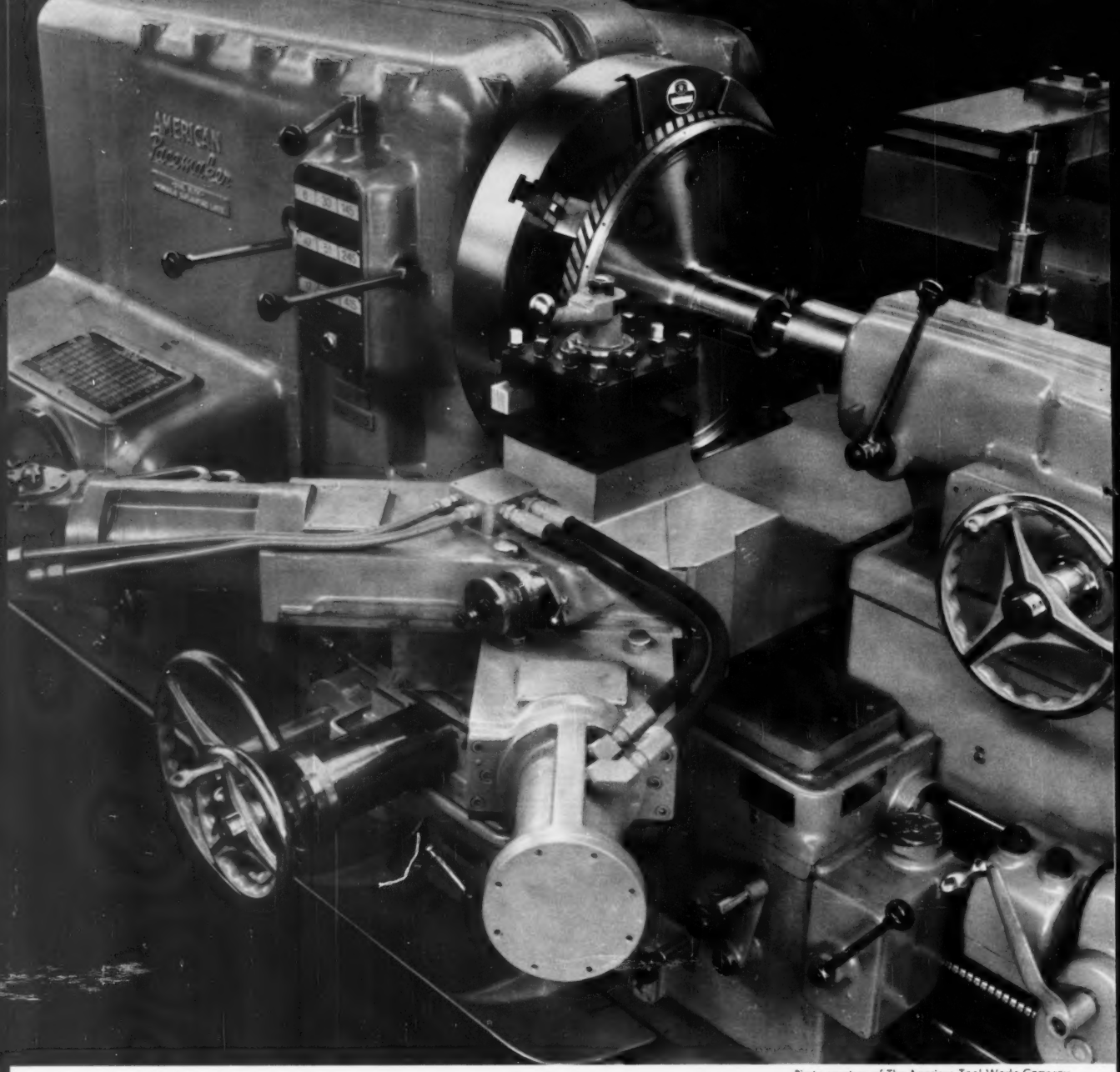


Photo courtesy of The American Tool Works Company

THE LATHE — *American Pacemaker 25" Style "G" Hydraulic Duplicating Lathe*

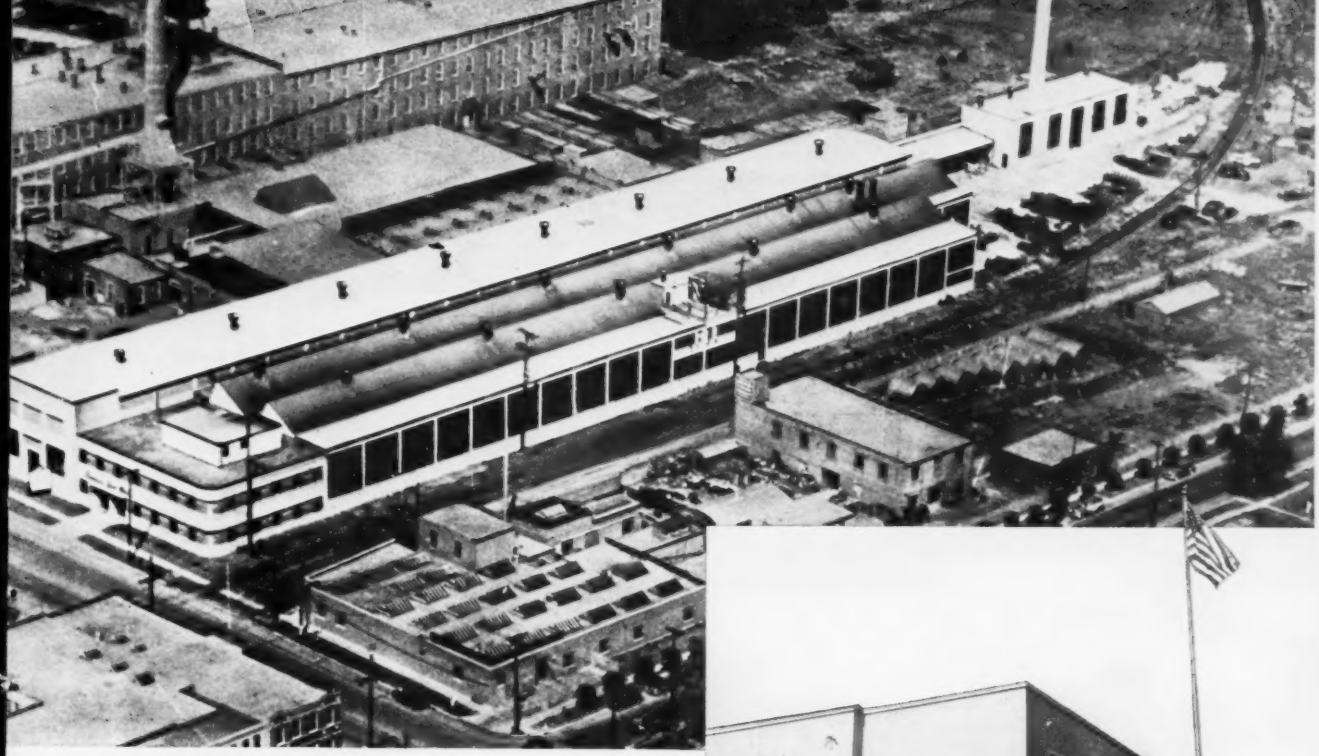
THE OPERATION — *Machining a jet engine compressor wheel*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON
Since 1851
CHUCK

Call Your Horton Distributor Now!



Rockford Plant

"We have found this program produces effective results!"

Chicago Plant

"The Goss Printing Press Company is the largest manufacturer of high speed Rotary presses. This heavy machinery is usually custom built to the specific requirements of our customers and this factor, in itself, has a big influence on our decisions regarding the type of equipment to be purchased. The majority of our equipment could be classified as general purpose machine tools.

"Over the past fifteen years, we have operated on the basis that it is good business policy to plough back earnings into new plant and equipment. I would be the first to acknowledge the importance of the support of our stockholders in this concept. The culminating step came in 1953 when we moved into a completely new plant in Chicago and, subsequently, purchased a subsidiary plant in Rockford.

"A little over seven years ago, we established a permanent staff function to handle the analysis of our equipment requirements. These people survey every piece of equipment at least once a year and, working with the foremen, they make their recommendations for replacement. They use the MAPI formula to check their recommendations, but their main point of guidance is the reduction in manufacturing hours estimated for the parts to be produced on any new piece of equipment. When comparing manufacturing hours, we normally expect the new equipment to bring a reduction of 25% of the hours called for on existing machines.

"The same staff follows new developments in the machine tool industry and highlights those which are applicable to our operation, and we should also mention that they make a post audit on all our new equipment after it is installed.

"We have found this program produces effective results, and we estimate that our overall manufacturing efficiency has increased by 6 or 7% over the last three years."

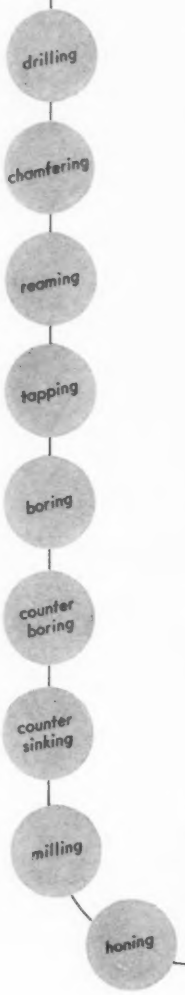
March, 1957

ROCKFORD
INSERT
GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When You Replace Machinery...

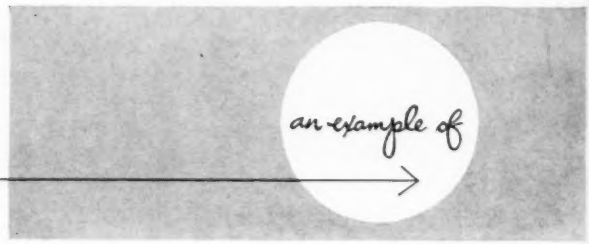
BARNESDRIL

complete automation | solves production problems



Whether it involves combining a series of machining operations into a single automatic cycle, combining a series of machines to meet production requirements or complete automation, BarnesdriL engineers can help you solve output problems to meet assembly needs. In the instance shown, a completely automatic machine was required to meet necessary demands for number of parts per hour and conveyor feed and carry-away production.

For 50 years BarnesdriL has been making hole producing and finishing machines to fit production schedules. If your requirements include any or all of the following operations — drilling, chamfering, reaming, tapping, boring, counterboring, countersinking, milling, honing — contact a BarnesdriL Factory Representative for specifications and production estimates on machines designed to hold your production schedule.



50th year

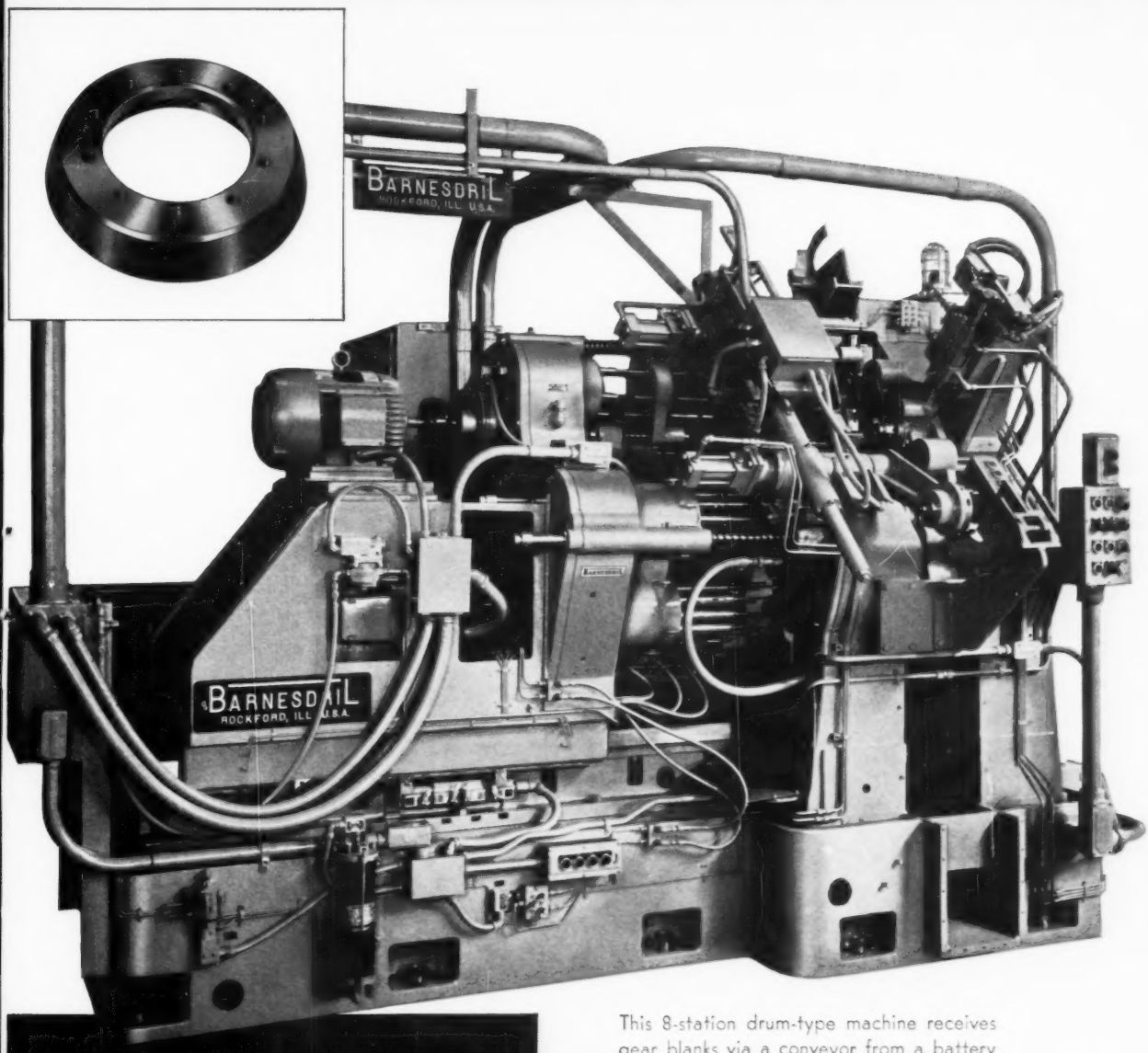
BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

Machinery, March, 1957

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

FROM DIESEL ENGINE TO



complete automation
designed and built by
BARNESDRIL

This 8-station drum-type machine receives gear blanks via a conveyor from a battery of lathes. The machine automatically loads itself, clamps and indexes the blanks through 7 separate stations. At the various stations the gear blanks are drilled, chips are blown out, holes gauged and probed, then chamfered, reamed and tapped. The blanks are then unclamped and automatically loaded onto another conveyor which carries the blanks to successive operations. If inadequate depth of holes, or broken tools, are detected at the probing station, the machine automatically stops and a red light appears on top of the machine. The machining cycle is resumed only after the part has been removed from the reject chute and proper tool adjustments have been made.

This is one of four such machines turning out over 800 parts per hour at 80% efficiency.

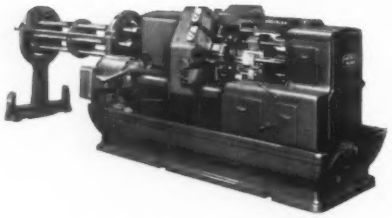
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

You get

FROM DIESEL ENGINE TO
ICE-CREAM FREEZER PARTS

AUTOMATIC BAR MACHINES

Handle All Types of Jobs



SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

✓ ***Efficiently...***
✓ ***Economically***

Greenlee design permits the handling of a wide variety of operations at various spindle positions ... makes it easier to split up long operations ... reduces idling time.

Threading, tapping and reaming can be performed in 3rd, 4th, 5th and 6th positions ... a special Greenlee advantage. Seven full-length T-slots on the main tool slide will accommodate the tools and attachments needed for a wide range of set-ups. Interchangeable cross-slide tooling and simplified cross-slide camming contribute to greater flexibility and faster set-ups.

Investigate! Ask any owner or operator ... they'll tell you that Greenlee is one of the most highly respected names in its field.

Write for Catalog No. A-405

GREENLEE
BROS. & CO.

1863 MASON AVE.
ROCKFORD, ILL.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

You get

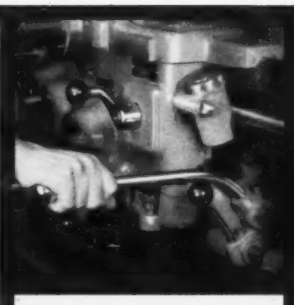
top value per dollar

with a Hendey No. 2E Lathe

timesaving control features

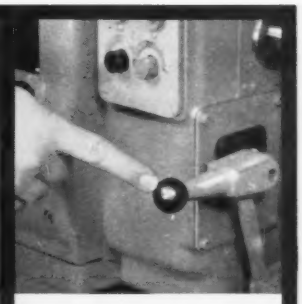
make skilled hands more productive!

Operator quickly and easily adjusts speed control dial (with machine under load) to most efficient cutting speeds. Electronically controlled drive gives limitless number of speeds, between 15 and 1500 rpm.



This lever provides faster, easier control of the tool when cutting threads. Speeds operation when chasing odd threads which cannot be picked up on the thread-chasing dial, and on short-run jobs.

Speeds of 30 to 1500 rpm are available on belt drive. Back gears provide speeds of 15 to 187 rpm. Belt with teeth assures positive rotation. Drive pulley is mounted independently on anti-friction bearings.

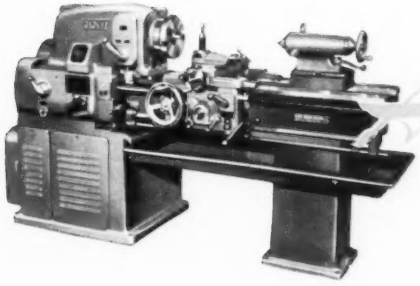


Electric brake stops spindle within two seconds, even from the highest speed. There's no coasting or waiting between cuts; spindle is started, stopped, and reversed from preset speeds quickly, easily.

For general-purpose turning not requiring a geared drive, the Hendey No. 2E gives you top value per dollar . . . with more torque at low speeds . . . a more efficient drive and a more sensitive speed control . . . more of the versatile features you need to speed your jobs and control your costs.

This lathe is easy to operate at the most efficient cutting speeds. You get an infinite range, right at your fingertips. It's the only 14 in. general-purpose lathe that can be equipped *in minutes* with an optional tracer attachment for efficient contour turning on short-run jobs. In the moderate price class, the Hendey Model No. 2E pays for itself quickly out of savings. Contact your Hendey dealer for details and complete specifications.

for precision with production buy Hendey



Hendey **machine division**

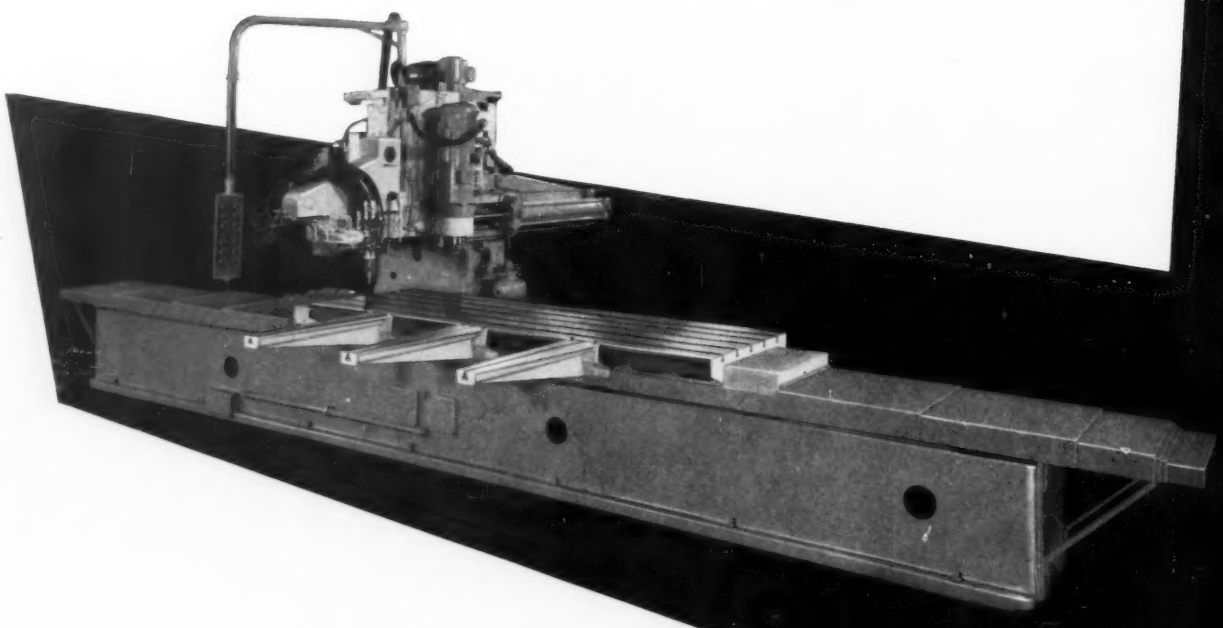
BARBER-COLMAN COMPANY

43 Loomis St., Rockford, Illinois

THE BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

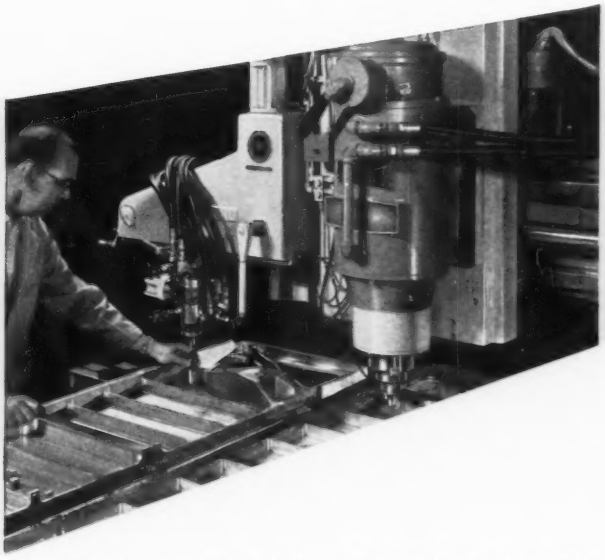
new hydraulic planer-type **air-frame mill**



Machinery, March, 1957

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

for fast, high-precision machining of aluminum air-frame parts



Specifically designed for fast, high-precision machining of variable and complex, 3-dimensional shapes, this new air-frame mill speeds the machining of aluminum air-frame parts. Equipped with a highly sensitive, 3-dimensional hydraulic tracer valve for contour work, the machine also has a depth control valve for 360° tracing. Machining is traced from wood, plastic, metal, plaster of paris models, or actual parts. Available in sizes to 36" x 36" x 10 feet.

Features

30 HP Hydraulic
Counterbalanced Head
Controlled Pressure Lubrication
4-Position Depth Control Turret
Interlocks "To Fail Safe"
Swiveling Pendant
Panel Mounted Valves

Accessories

Telescoping Way Guards
Template-Support Brackets
Spray Coolant for Milling Cutter

QUICK FACTS BY PHONE

Call 3-7611
Rockford, Illinois

Or write direct for a representative to call with detailed specifications.

ROCKFORD MACHINE TOOL CO.

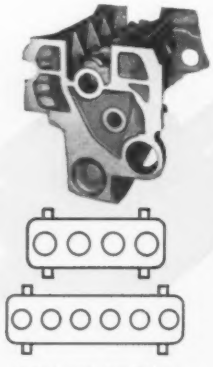
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

HYDRAULIC

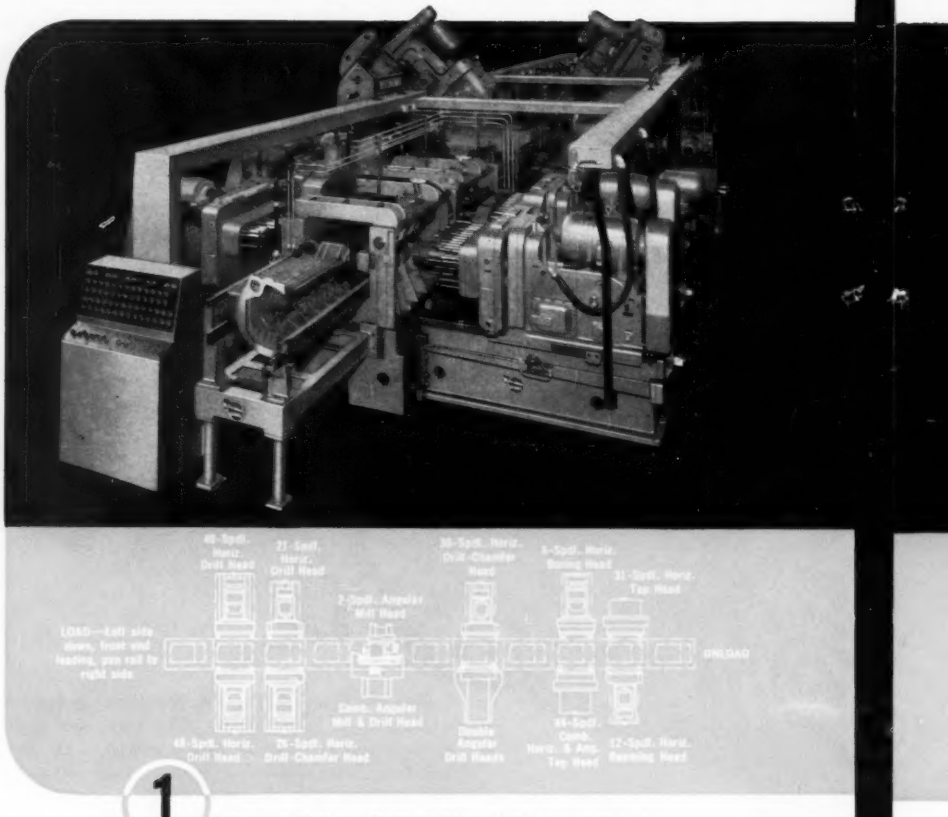
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

DUAL-PURPOSE SPECIALS

● Here's another outstanding example of how W. F. & John Barnes Coordinated Creative Engineering and Manufacturing Service has helped cut production costs . . . this time for a well-known farm equipment manufacturer. These three special machines have been ingeniously designed to machine TWO SIZES of tractor engine blocks . . . double-duty performance that not only means a lower original investment, but also simplifies tooling, reduces floor space requirements, and increases over-all production efficiency. Careful planning of tooling and machine components holds change-over time to a minimum . . . in fact,



Both 4 and 6-cylinder blocks are processed on the same Barnes' Special Machines.



SAVE TIME WITH BARNES' COORDINATED 6-POINT BUILDING SERVICE

"Shopping around" is often a costly, time-consuming task, and all too often the results are disappointing . . . that's why Barnes offer a complete machine tool building service from *one convenient source* . . . it saves time and cuts costs because all the work is coordinated in one plant. Barnes' service includes:

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
2. **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.
3. **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.
4. **SPECIAL GAUGES, FIXTURES, TOOLS**—designed for each individual machining problem, assure accuracy of operations at high production speeds.
5. **SPECIAL HANDLING AND CONVEYOR EQUIPMENT**—designed and built to reduce work handling, effect maximum safety and efficiency.
6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

1 Barnes 11-Station Progress-Thru Machine completes drilling, tapping, and milling operations on the 4 and 6-Cylinder Diesel Engine Blocks. Bushing plates, guide rails, head stops, transfer pusher fingers, and other machine components are quickly adjustable to handle both block sizes.

W. F. & JOHN BARNES

Builders of Better Machines Since 1872

Multiple Spindle Drilling • Boring

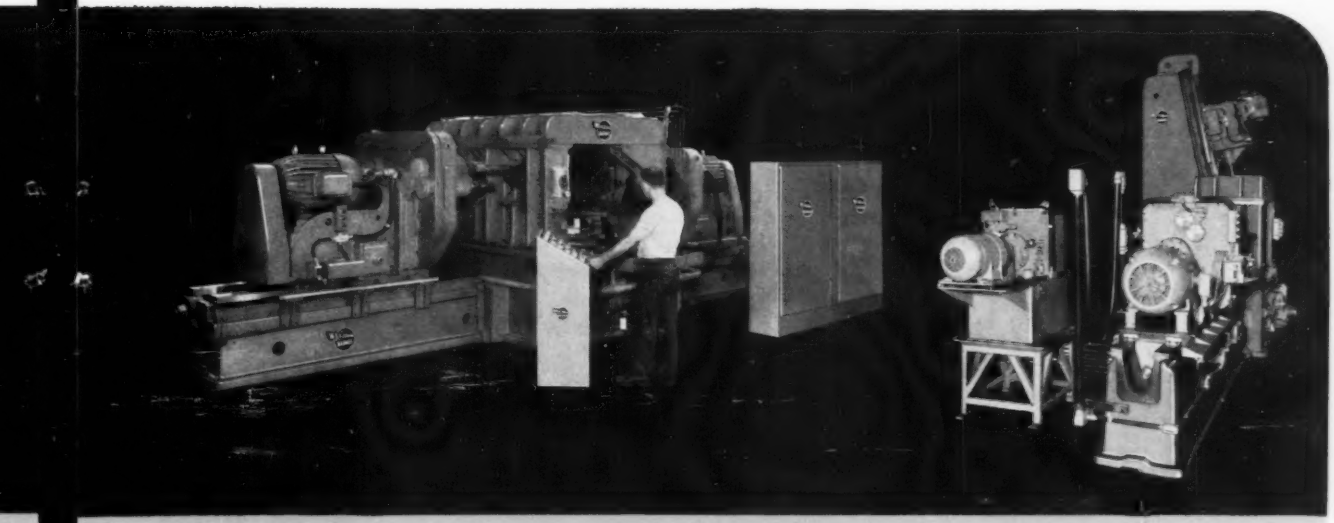
• MACHINE BOTH 4 AND 6 CYLINDER ENGINE BLOCKS

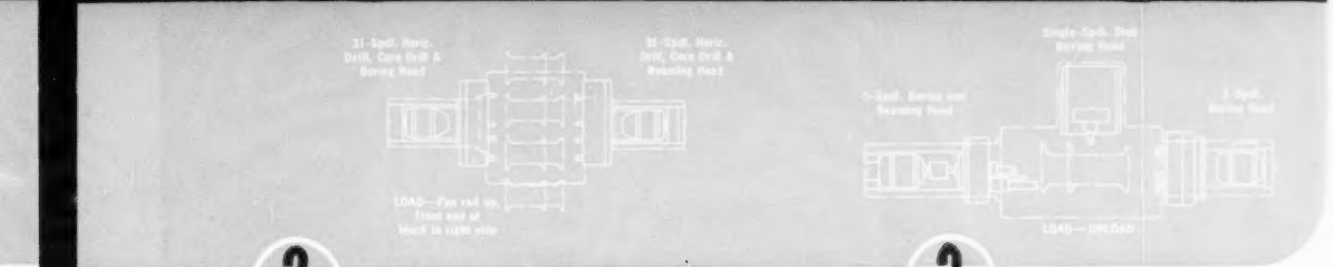
much of the tooling is common to both block sizes and does not require changing. Bushing plates, guide rails, head stops, and transfer pusher fingers quickly and easily adjust to accommodate for variations in the two block designs. Where tooling changes are required, easy accessibility and quick conversion and set-up features speed the change-over.

OVER 75 YEARS OF MACHINE TOOL BUILDING EXPERIENCE

This unusual application is only one of many produced by Barnes . . . the result of over 75 years of accumulated knowledge in the highly specialized machine tool field. Creative skills, plus complete and extensive building facilities, assure you of machines possessing maximum capability for lowering production costs and improving product quality.

ASK FOR AN ANALYSIS OF YOUR PRODUCTION METHODS . . . YOUR PROBLEMS WILL RECEIVE EXPERT AND INDIVIDUAL ATTENTION





2 Barnes Special 4-Station Progress-Thru Machine completes drilling, boring, and reaming on the blocks. Here again, adjustable features are built in to compensate for the two block sizes. Electrical interlocks on these machines prevent accidental tool damage during change-over. Idle stations are included for future tapping operations.

3 Special 3-Way Cam and Crank Boring Machine precision bores both block sizes. Adjustment features are similar to the preceeding machines. All units are electrically controlled for automatic cycle sequence with push-button operation.

Write Today **FOR YOUR COPY** of "Coordinated Machine Engineering"—a 32-page booklet of automation equipment ideas.

W. F. & JOHN BARNES COMPANY

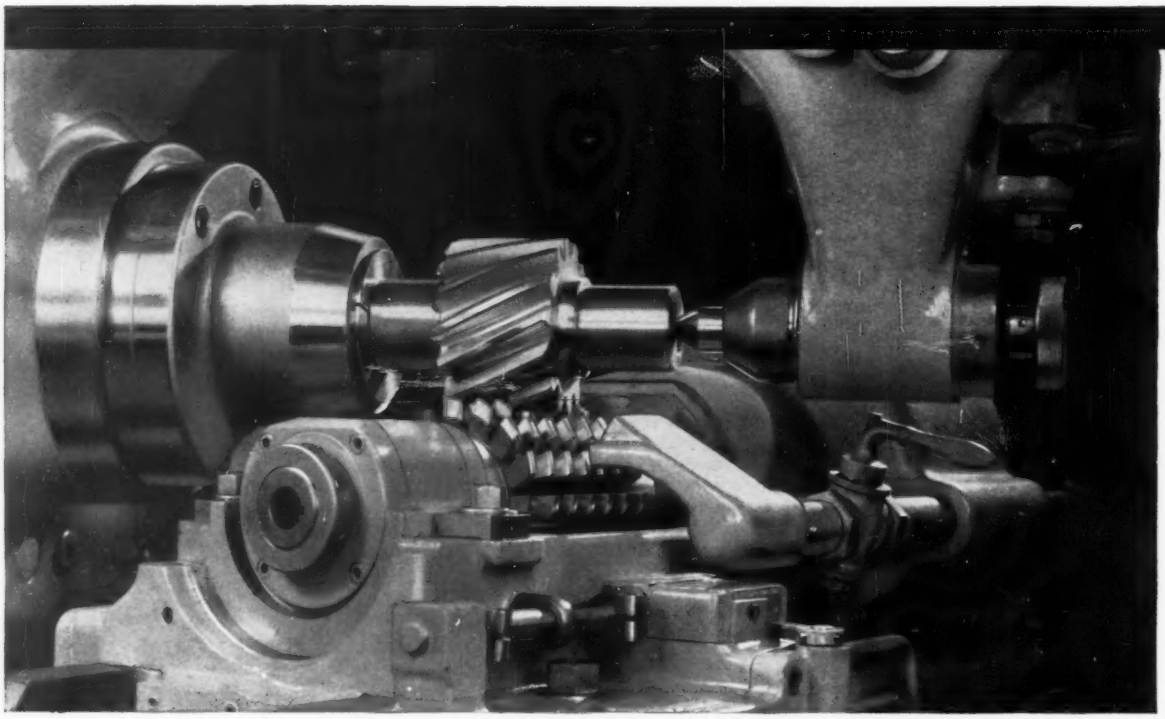
402 SOUTH WATER STREET, ROCKFORD, ILLINOIS

Tapping Machines • Automatic Progress-Thru and Transfer Type Machines

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

crown hobbing

saves time and cost in producing accurately crowned gears



Crown-hobbing on this special Barber-Colman No. 14-15 Hobbing Machine is an ideal production method of generating crowned gear teeth. Where gears are now hobbed and then crown-finished in a secondary operation, they may be crown-hobbed in one operation. When a hobbed finish is satisfactory, the shaving operation can be completely eliminated. If the degree of finish required calls for a further finishing operation, such gears may be finished after crown-hobbing at less cost and in less time because hobbing provides uniform stock removal.

Crown-hobbing also makes it possible to hold a change in tooth thickness within the desired limits, and the tooth bearing can be located at the most desirable point consistent with the job conditions.

In the operation shown here, 4 DP., 14T, 18° P.A. transmission gears with 2¾" face are crown-hobbed on a special Barber-Colman No. 14-15 Hobbing Machine. Teeth are hobbed with a change in tooth thickness of .0045". The automatic cycle includes rough hobbing R. to L. at a given depth, automatic lowering of the work slide against the crowning cam, climb hobbing L. to R. at a constantly changing depth, and rapid traversing out of cut. No further finishing is required in this particular case, and the gears are completed in one automatic operation, without changing tools or transfer to other machines. Savings on this part can be expected on the basis of the following comparison:

typical gear-crowning	crown-hobbing
Rough hob gear teeth.	Manually unload and load.
Transfer to other machine.	Automatic cycle — rough hob.
Semi-finish hob gear teeth.	R. to L., set to finish depth,
Transfer to next machine.	and crown hob L. to R.
Crown-finish gear teeth.	Manually unload and load.

The machine can be designed to suit your job requirements, either as a single-purpose machine, or as a universal machine for both crown and conventional hobbing. Parts can be hobbed in one or two cuts, depending upon specifications of the part. The cam can be designed to produce the tooth configuration required.

The machine required for crown-hobbing is provided with a cam mechanism for raising and lowering the work slide to produce a change in tooth thickness. The work slide is held against the rotary cam by hydraulic pressure in addition to its own weight. Change gears are provided in the cam drive so that different amounts of change in tooth thickness can be produced with the same cam.

Send us drawings of your crowned-gears. Our engineers will analyze the job conditions and make recommendations for crown-hobbing.

BARBER-COLMAN COMPANY

723 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

"Engineered Production" Service

FOR BROACHING

It takes all 3

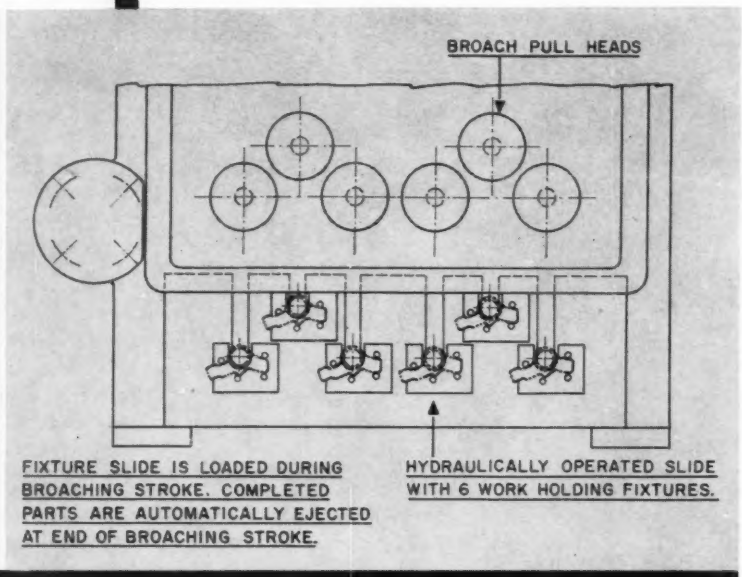
American's *"Engineered Production"* Service . . . gives the broach-user the complete three-part service that is vital for handling a production broaching job. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

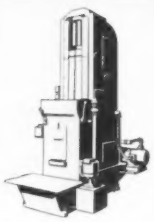
THE JOB Broaching I. D. of hole in exhaust valve rocker. High production required.

THE RESULT 1200 parts per hour, broached *six at a time*, on vertical internal pull-up machine equipped with sliding fixture.

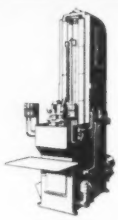
1 PROPER BROACH TOOL DESIGN

Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers, stock removal, length and width of cut, finish, tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of the work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.

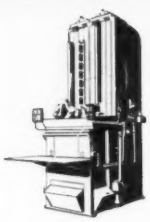

BROACH PULL HEADS
FIXTURE SLIDE IS LOADED DURING BROACHING STROKE. COMPLETED PARTS ARE AUTOMATICALLY EJECTED AT END OF BROACHING STROKE.
HYDRAULICALLY OPERATED SLIDE WITH 6 WORK HOLDING FIXTURES.



Three Way

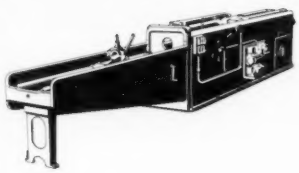


Single Ram



Duplex Ram

Presses



Horizontal

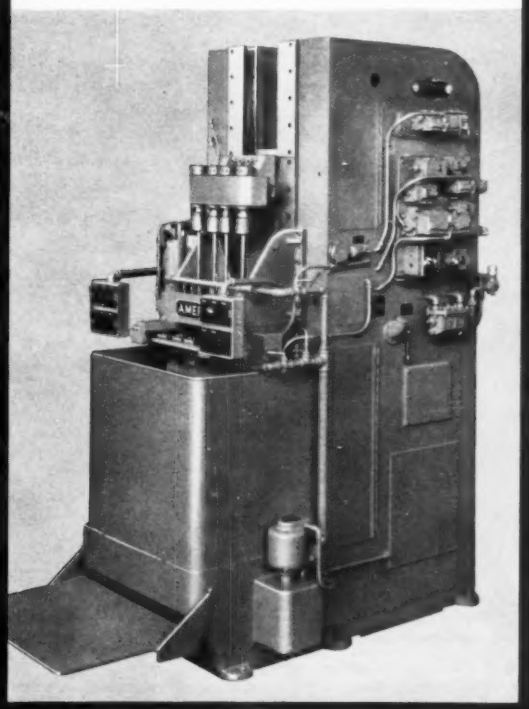
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

How to improve

to give you peak broaching performance

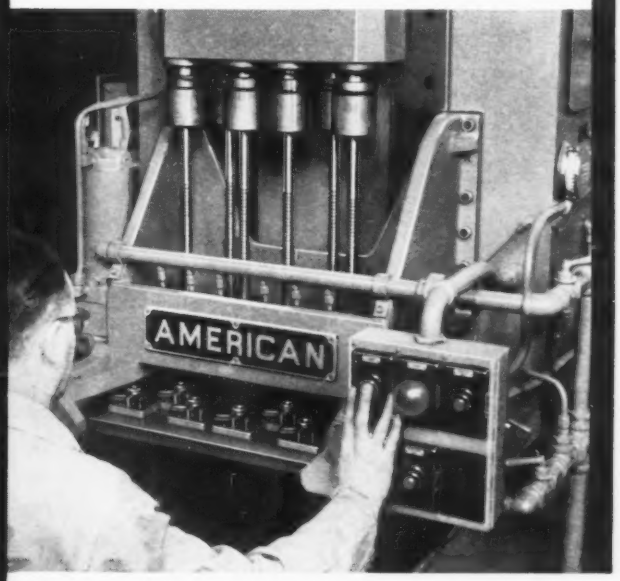
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, and available floor space dictate the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. Because American builds a complete line of standard machines and has extensive experience with specials, you can depend on getting the most practical machine for your job.



3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, workholding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.



WRITE for Bulletin A612 for more information on practical broaching methods by American.

SUNDSTRAND AMERICAN *American* BROACH & MACHINE CO.

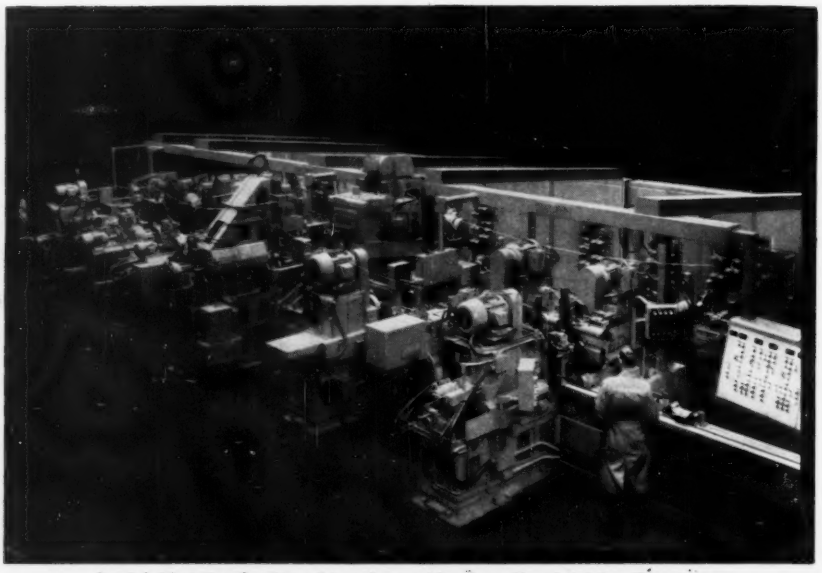
A division of SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First —for the Best in Broaching Tools, Broaching Machines, Special Machinery

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

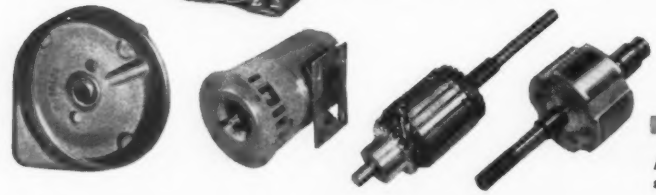
How to improve MACHINING METHODS FOR with Sundstrand "Engineered Production"



Special 14-station Sundstrand transfer machine for ruff and finish milling, boring, drilling, and tapping various sizes and types of motor frames.

● Here are seven interesting examples of Sundstrand "Engineered Production" as applied to the manufacturing of electric motors. These motor components vary in size and operations required. Each is machined on Sundstrand equipment with the method best suited to the production requirements of the plant in which they are installed. Greater output, improved quality and lower unit costs are the direct results of applying Sundstrand "Engineered Production" to your machining problems.

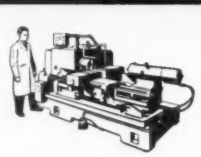
If you are manufacturing electric motors of any type, the practical experience of Sundstrand engineers on numerous jobs similar to yours is sure to pay off in improved machining methods. Either your nearby Sundstrand field office or the engineering department at the home office will be glad to discuss your manufacturing problems without obligation.

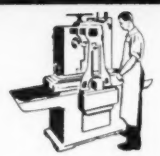


Motor frames, commutator assemblies, armature assemblies, rotors, shafts, etc., all machined on Sundstrand equipment.

SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

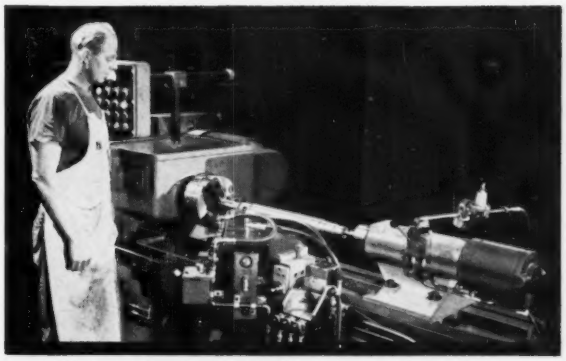




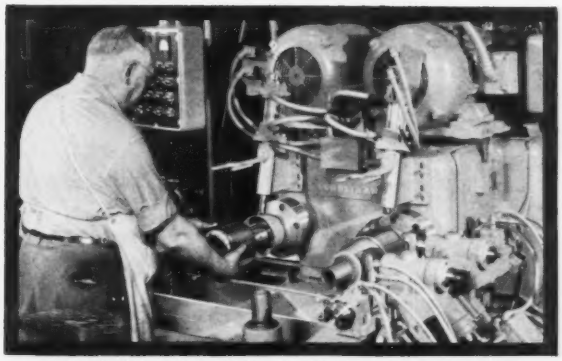
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 38—VACUUM PUMP ROTORS

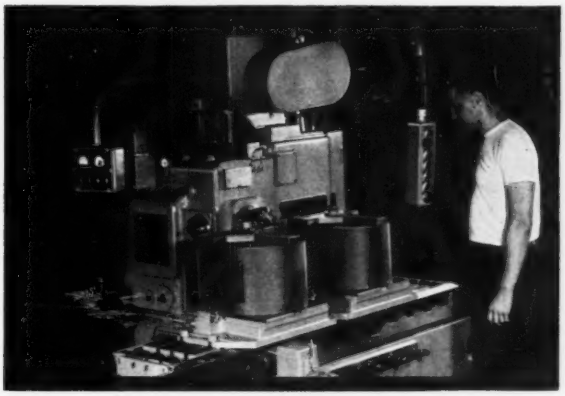
ELECTRIC MOTOR PARTS



Turning both ends of various sizes of motor shafts using a Sundstrand Multi-Cycle Tracer Lathe.

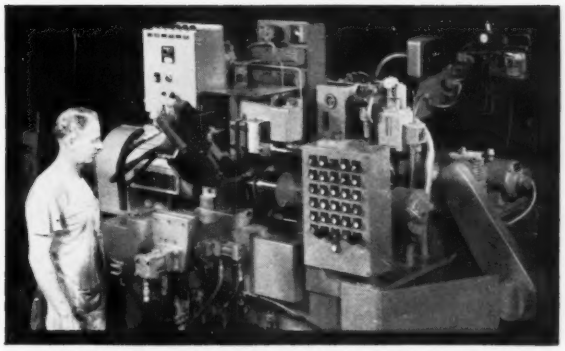


Facing, boring, and chamfering of both ends of stator assemblies on 2-spindle lathe. Operator loads and unloads one spindle while machining at second spindle.



Milling feet on various sizes of stator frames on Sundstrand Rigidmil.

Special mill for boring stator frame assembly. Parts are loaded and unloaded at one station during machining at opposite station.

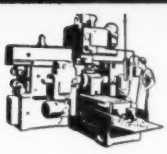


Special Sundstrand Lathe for turning, chamfering, and reaming rotor assembly. Machine has automatic tool re-setting, gaging, loading and unloading.

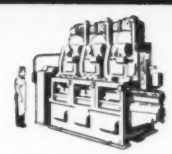
Turning rabbet fits on stator frames using Sundstrand Lathe. Machine handles standard motor frames from 204 thru 284 NEMA sizes.

ADDITIONAL DATA on Sundstrand's "Engineered Production" for jobs like these is available. Send part prints for a specific analysis today.

TRIPLEX RIGIDMILS



SPECIAL MACHINES



SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 39—FORGED STEEL CHAIN LINKS

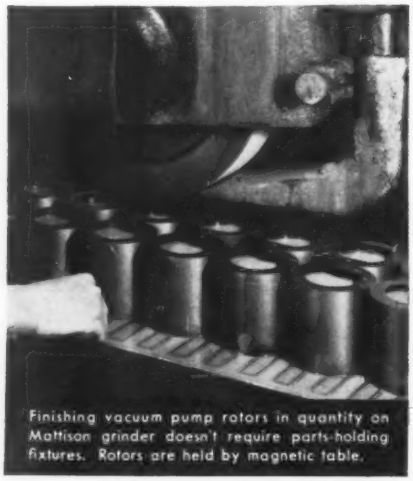
CASE HISTORY NO. 38—VACUUM PUMP ROTORS

MATTISON
HIGH-POWERED
PRECISION

GRINDING METHODS

Courtesy: Central Scientific Co., Chicago, Ill.

Switch to Mattison surface grinder doubles output ... consistent accuracy speeds assembly



Finishing vacuum pump rotors in quantity on Mattison grinder doesn't require parts-holding fixtures. Rotors are held by magnetic table.

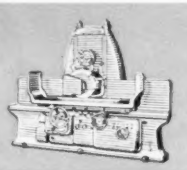
Not only is output doubled, but improved accuracy being achieved on this Mattison high-powered precision surface grinder enables rotors for high vacuum pumps to be assembled more rapidly. Production now is 50 parts per hour compared to 12 to 25 per hour with former grinding method.

Stock removal on this job is .0015 inch with a high degree of accuracy required. Both parallelism and flatness are held to .0003 inch to assure consistent pump performance at very low pressures.

Greater accuracies also are being realized in machining a wide variety of other scientific apparatus parts. Very thin vanes for another vacuum pump, previously ground one at a time, are now ground in production lots. Reproduceability is greatly improved.

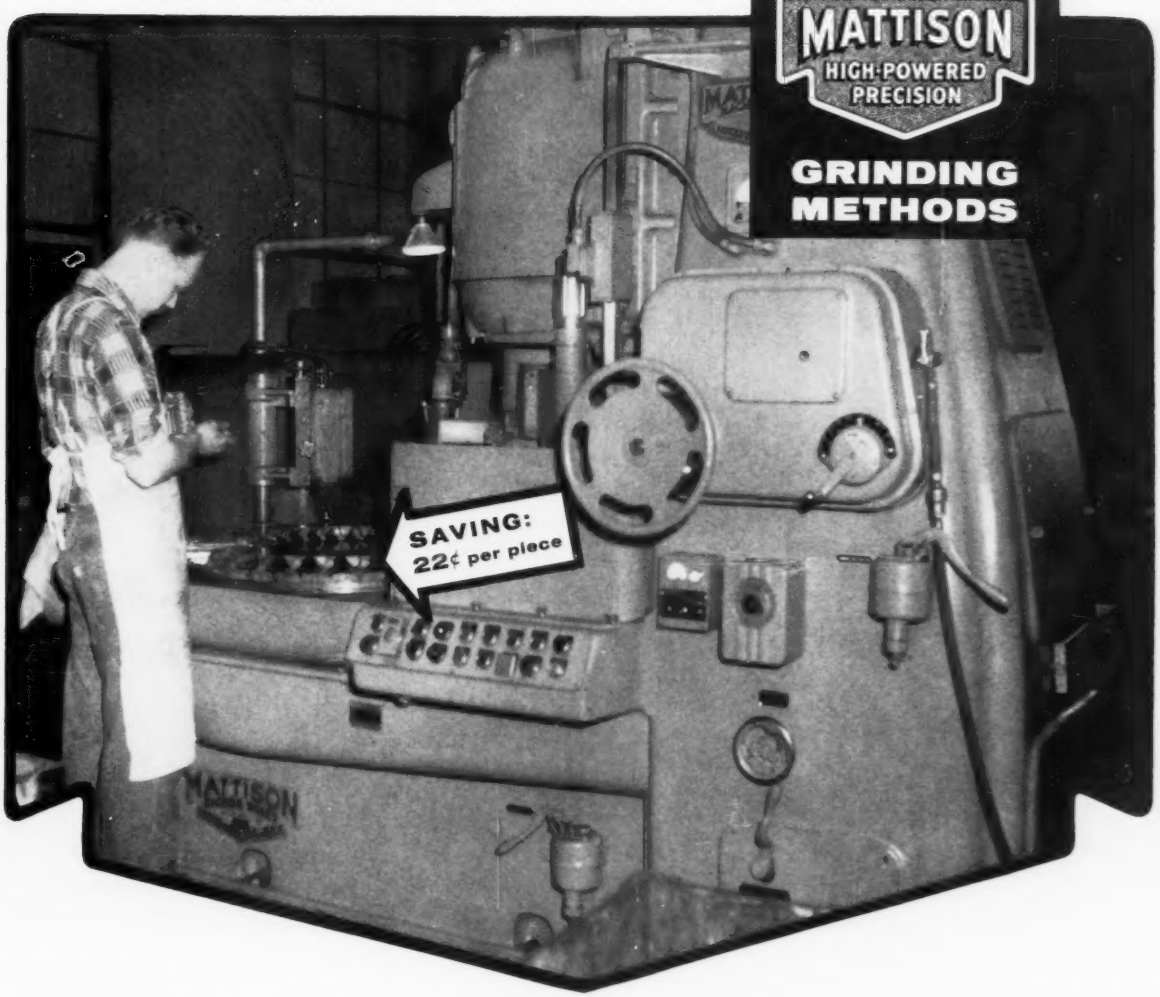
Like every Mattison grinder, this horizontal spindle unit features high horsepower and rigid construction—the design combination that means ability to handle a wide range of work with unmatched accuracy at high production rates.

IF IT'S A FLAT SURFACE THERE IS A MATTISON TO GRIND IT



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 39—FORGED STEEL CHAIN LINKS

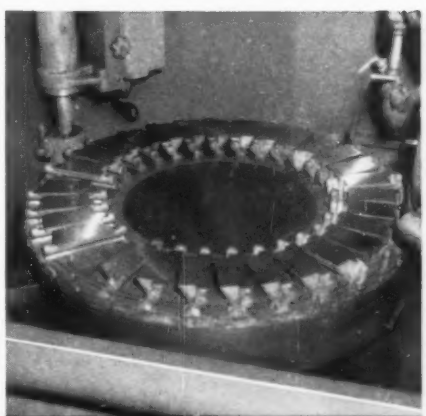


Change from milling to high-powered surface grinding saves 22¢ per piece!

Formerly, these 4140 drop-forged chain links were milled, 100 pieces every three hours, using high-speed steel cutters. Eighteen pieces were produced between sharpenings. At 35 minutes per sharpening, 3.2 hours of cutter maintenance were required for every three hours production at a labor cost of $16. This, plus machining cost of 15¢ per piece, gave a total cost of 31¢ each.

Today, links are machined, 30 pieces per load, at rate of 100 pieces per hour on the Mattison No. 24 Automatic Cycling Vertical Spindle Surface Grinder, equipped with 40 hp spindle motor. Stock removal is .140 in., at .016 in. minimum downfeed per minute. Wheel cost per piece is 4¢, but maintenance cost is eliminated because wheel is self-dressing. With a labor and machine cost of 5¢ per piece, total cost to grind is only 9¢—a saving of more than 22¢ per piece, plus additional savings in cost of cutters.

Mattison Vertical Spindle Rotary Surface Grinders offer continuous downfeed and automatic cycling and sizing of work, to machine large or small flat surfaces accurately and fast. Send your parts to the Mattison Methods Laboratory for a sample grind and production estimate.

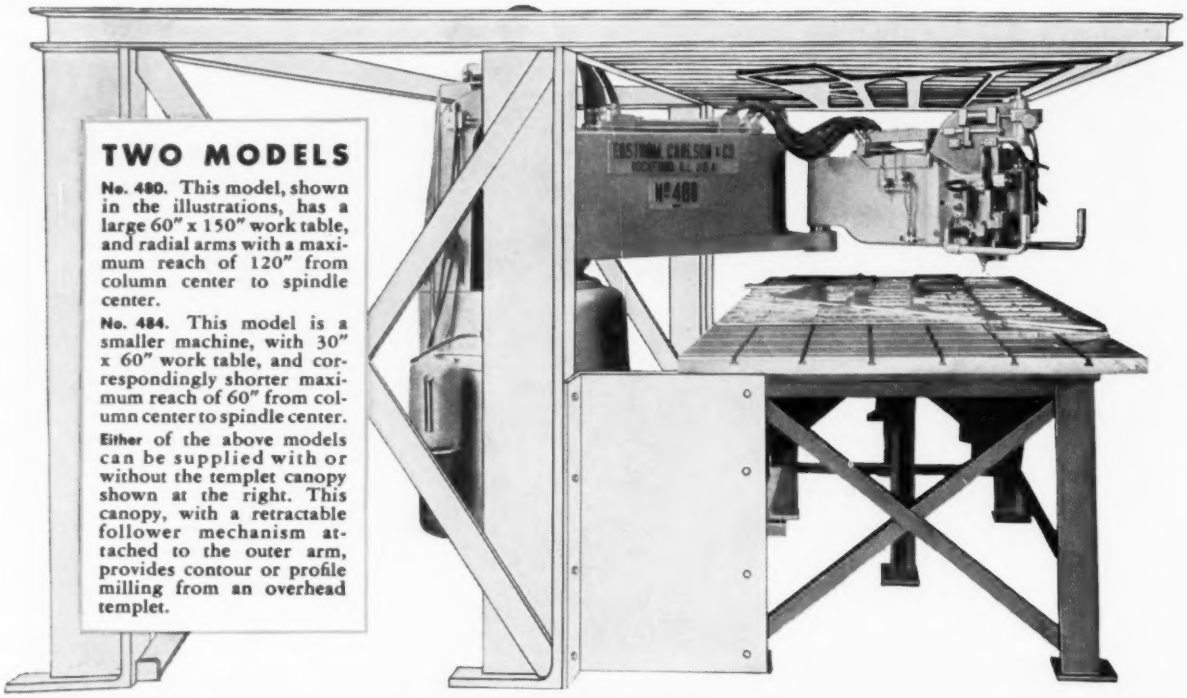


Automatic sizer gauges parts continuously and stops automatic grinding cycle when finish size is reached.

MATTISON MACHINE WORKS ROCKFORD, ILL. U.S.A.

HIGH-POWERED
PRECISION
SURFACE GRINDERS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



TWO MODELS

No. 480. This model, shown in the illustrations, has a large 60" x 150" work table, and radial arms with a maximum reach of 120" from column center to spindle center.

No. 484. This model is a smaller machine, with 30" x 60" work table, and correspondingly shorter maximum reach of 60" from column center to spindle center.

Either of the above models can be supplied with or without the templet canopy shown at the right. This canopy, with a retractable follower mechanism attached to the outer arm, provides contour or profile milling from an overhead templet.

EKSTROM, CARLSON

RADIAL-ARM DEPTH AND CONTOUR MILLS

Manually-operated, radial-arm machines are recognized by airframe builders as the *fastest* and *most economical* for profile or contour milling. These new Ekstrom-Carlson profile milling and routing machines have the *additional* feature of *depth milling.* For low initial cost, low maintenance, and high production capacity, there is no other machine or method that will out-perform the new Ekstrom-Carlson No. 480 and No. 484.

NEW STANDARDS OF HIGH PERFORMANCE!

Outstanding machine-tool performance is due largely to important features: Rigidly designed base, column, and arm structures are machined to close limits for accuracy. Hydraulically-actuated cylinders, mist lubrication to motor bearings, independently operated follower and cutterhead assemblies with double slides, four-position depth stops with micrometer adjustments, water-cooled cutterhead motors, drawbar type collets, and many other valuable improvements. For details, write for data and specifications — or see your Ekstrom-Carlson representative.

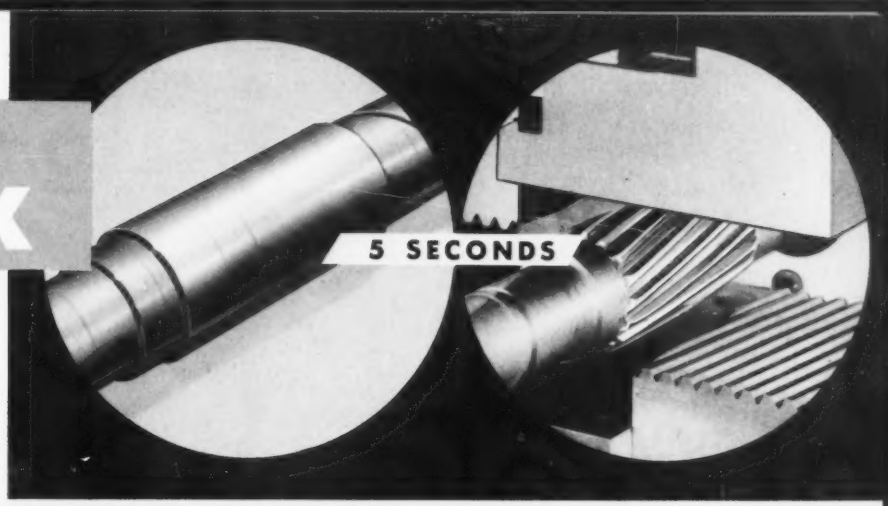
EKSTROM, CARLSON & CO.

1400 RAILROAD AVE., ROCKFORD, ILL.
Machine Tools, Special Machines, Cutters
SINCE 1910

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

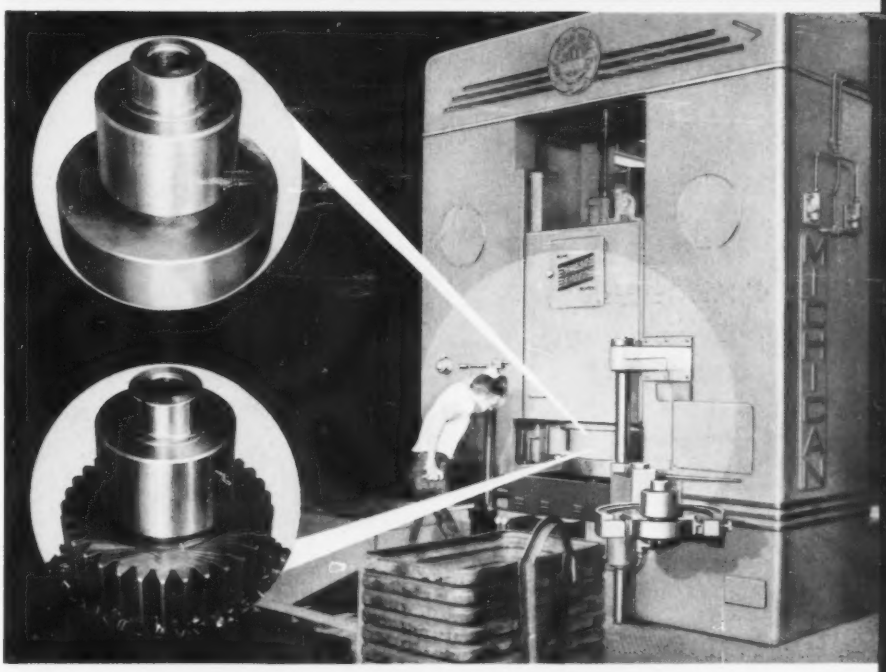
This Month's

GEAR PIX



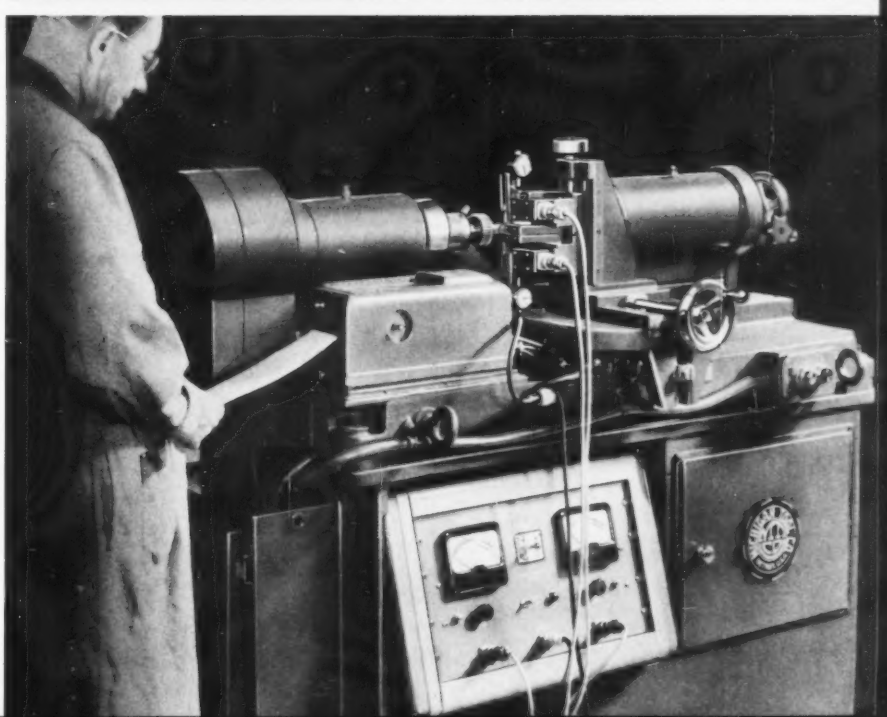
SPLINE ROLLING IN ONLY 5 SECONDS . . .

. . . That's all it takes to roll-form this helical spline with the Michigan Roto-Flo "chipless production" process. Floor-to-floor time, with automatic loading, is 17 seconds. Cold metal displacement produces required dimensions from blank diameters less than the PD and OD. As accurate as machining, the process produces superior surface finishes. Want more data? Just ask for our application Bulletin RF-55.



GEARS FOR ROADBUILDING EQUIPMENT . . .

. . . are readily cut on this automatically cycled Michigan Shear-Speed. The heavy 33-tooth gear shown (3¾-in. face width) is produced at 5½ pieces per hour, removing over 10 lbs. of SAE 8622 steel as chips. Cutting speed is 17 fpm. Let us send you Bulletin SS-55 telling the full story of large gear shaping.



AUTOMATIC CHECKER FOR HIGH PRECISION GEARS . . .

. . . designed particularly for aircraft and special-purpose spur gears. Cuts time needed for checking and recording parallelism, tooth taper and tooth spacing to 16% of normal. Handles gears from ¼ to 2½-inch face width and up to 14 inches diameter. Readings are automatically and permanently recorded by a built-in recorder for easy comparison. Ask for Bulletin 481-A.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

This Month's

GEAR PIX

AUTOMATIC LOADING UPS GEAR SHAVING OUTPUT . . .

. . . and releases the operator for preliminary gear checking. Mechanical loaders on standard machine tools (shown here: a Michigan Gear Shaver) offer a middle ground of automation that pays off immediately in output per machine-hour without increasing the work load of the operator. It's also safer.

READY SOON— A TANDEM HOBBER . . .

. . . latest addition to the Michigan line of hobbers features self-contained checker, automatic size control, loading and unloading, and chip disposal. You'll be able to set two or more of these hobbers in series for continuous through-feeding of parts. Literature coming off press soon—drop us a line now.

FROM RESEARCH— BETTER MACHINES, BETTER GEARS . . .

. . . Michigan machines and tools of tomorrow—for the controlled-quality, easier-made gears and splines to come—will owe much to the work of our research staff. This stepped-up development activity, now housed in new facilities (one section of which is shown), will carry on the scientific study basic to gear progress. New methods, machines and tools are sometimes the best answer to requirements of a particular manufacturer. If you have a problem in the area of gear and spline production, we will be glad to talk it over.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

still the winner

... and in high speed steels, nothing beats REX

The winner and still champion after fifty years is Crucible's REX high speed steel. *And now it's better than ever!* Recent improvements in manufacturing processes have given even higher quality and greater uniformity to every one of its properties.

Why not shop test the new REX yourself? Test it for size, structure, response to heat treatment, fine tool performance. Give it any test you wish. You'll see why it is today, as it has always been — *the standard by which all other high speed steels are compared.*

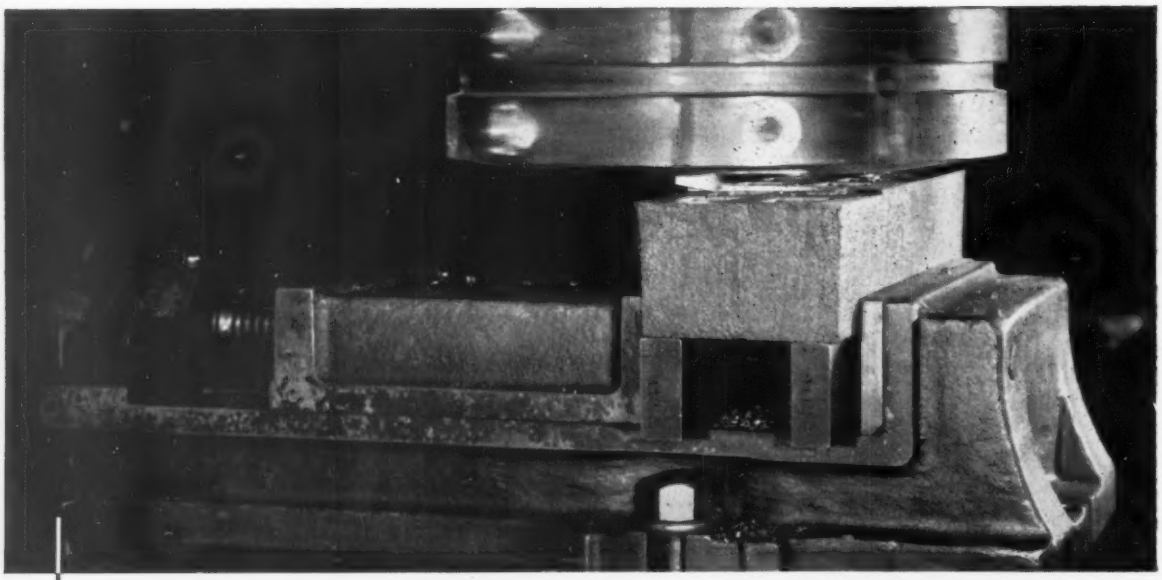
Ask for REX by name at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for information on REX, and the other Crucible special purpose steels, send for the *Crucible Publication Catalog. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

On any material, any job . . .

INCREASE PRODUCTIVITY, CUT UNIT



Output boosted 20%-30% with Grade 860

Milling gray cast iron. Cemented carbide increased production, yet provided longer tool life, better finishes on the new hard, dense types of gray cast iron. Tests on simulated engine blocks (above) showed Grade 860 took interrupted cuts with minute wear, no chipping . . . while other carbides showed extensive chipping and cratering.

Production rate doubled with Grade 370 tool

Turning 4340 steel. High-impact cutting involved on this special aircraft shaft caused rapid dulling of conventional carbides; several work stoppages per shaft occurred while tools were reground. Today, Synchro Devices, Inc., turns a complete shaft with a single Grade 370 tool . . . also gets double the production.

Daily regrinding ended by Grade 883 cutters

Gang-milling plastics. Cotton-impregnated plastic-like plugboards were so abrasive that steel cutters were down for costly, time-consuming regrinding almost daily. Switching to Carboloy Grade 883, International Business Machines Corp. milled 900,000 boards with the carbide-tipped cutters without sharpening.

COSTS WITH CARBOLOY® CARBIDES

- Take heavier cuts, at faster speeds and feeds
- Lower tool cost per piece, boost machine efficiency

Whether you're cutting steel, cast iron, aluminum—or even nonmetallics like plastics—Carboloy carbide grades will keep machines running longer at top efficiency.

Carboloy cemented carbides make your machines more productive because they take greater speeds and feeds . . . give you more output per grind. And, they'll cut unit costs through lower downtime, grinding, and maintenance costs . . . give you more production per tool. It adds up to a more efficient – and therefore, more profitable – machining operation.

Wide choice of grades

If you're cutting steel, for example, use Carboloy Extra-Performance Grades 350 and 370. These grades have proved their superiority over conventional carbides in hundreds of applications . . . doubling and tripling production in many cases.

If you're milling high-tensile cast irons, there's Carboloy Grade 860. This carbide provides greater resistance to chipping and cratering. Tests show it can increase production 20%-30%.

Or, if you're machining nonferrous materials like aluminum, brass, bronze, or titanium, you can choose from five Carboloy cemented carbides . . . and get the specific cutting characteristics you need for any job from precision finishing to heavy-duty interrupted cuts.

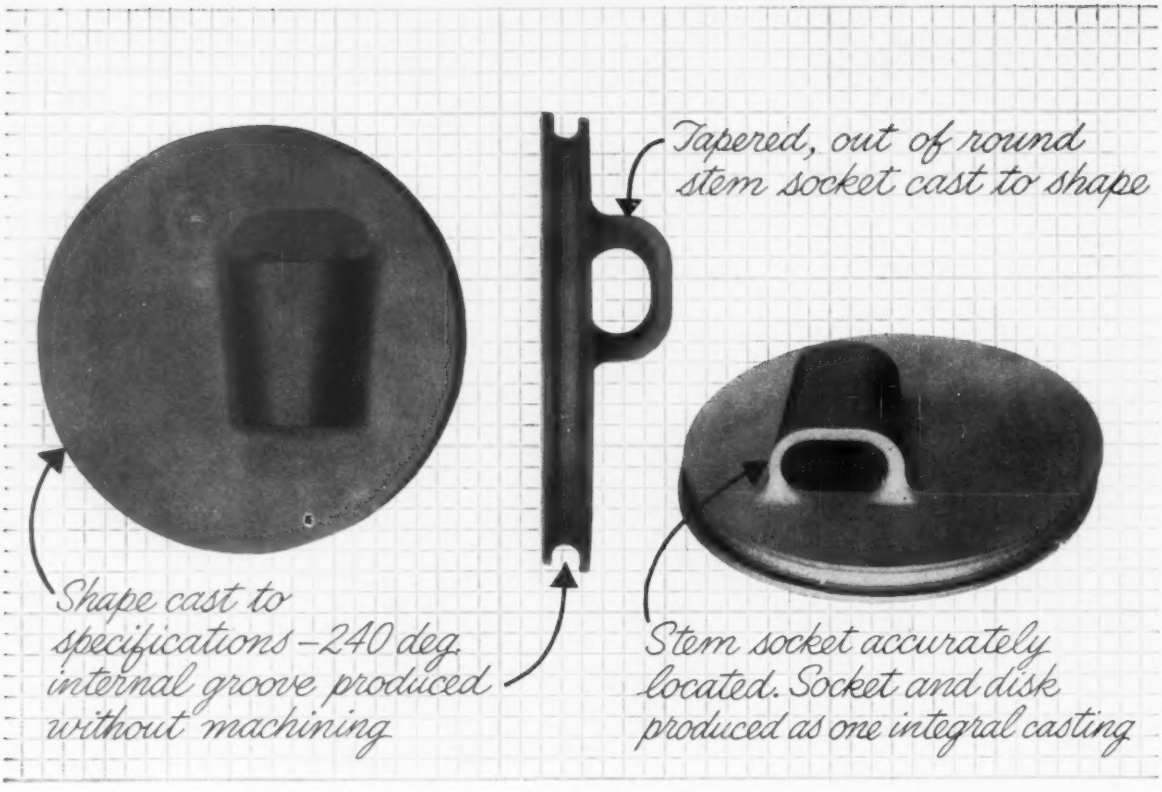
Broad range of products

Carboloy cemented carbides are locally stocked for immediate delivery by 139 Authorized Carboloy Distributors. They're available in the widest choice of styles and sizes in the industry.

Call your Distributor today (he's listed in the Yellow Pages). Or, send for a copy of Catalog GT-316, containing the new Grade Selection Guide for Carboloy cemented carbides. Write: *Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Road, Detroit 32, Michigan.*

Progress Is Our Most Important Product

GENERAL ELECTRIC


Tapered, out of round stem socket cast to shape
Shape cast to specifications – 240 deg. internal groove produced without machining
Stem socket accurately located. Socket and disk produced as one integral casting

Investment-Cast in One Piece . . . 5 Secondary Operations Avoided

This intricate valve disk and stem socket were investment cast at a considerable saving in machining, assembling, and joining costs. The disk is produced in an odd shape and has a concave rim with a 240-degree groove. There is a tapered, out-of-round recess in the stem socket. The disk and socket were designed and produced as one integral casting.

The shape of the disk, vital to the proper functioning of the part, was cast to size. A contour machining operation would have been required to produce this shape by other methods. The groove in the rim of the disk, and the stem socket, were also cast to size . . . thus eliminating two more difficult machining operations.

An assembly operation, which would have required precision locating devices, was also avoided. The stem socket had to be accurately located . . . 0.225 in. from the centerline of the disk. This location was held to within plus or minus 0.005 in. on the finished part by the investment-casting method.

Reducing production costs by eliminating secondary operations is only one of the many advantages of HAYNES' precision-investment-casting process. For the full story call or write to any of the District Sales Offices listed below:

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

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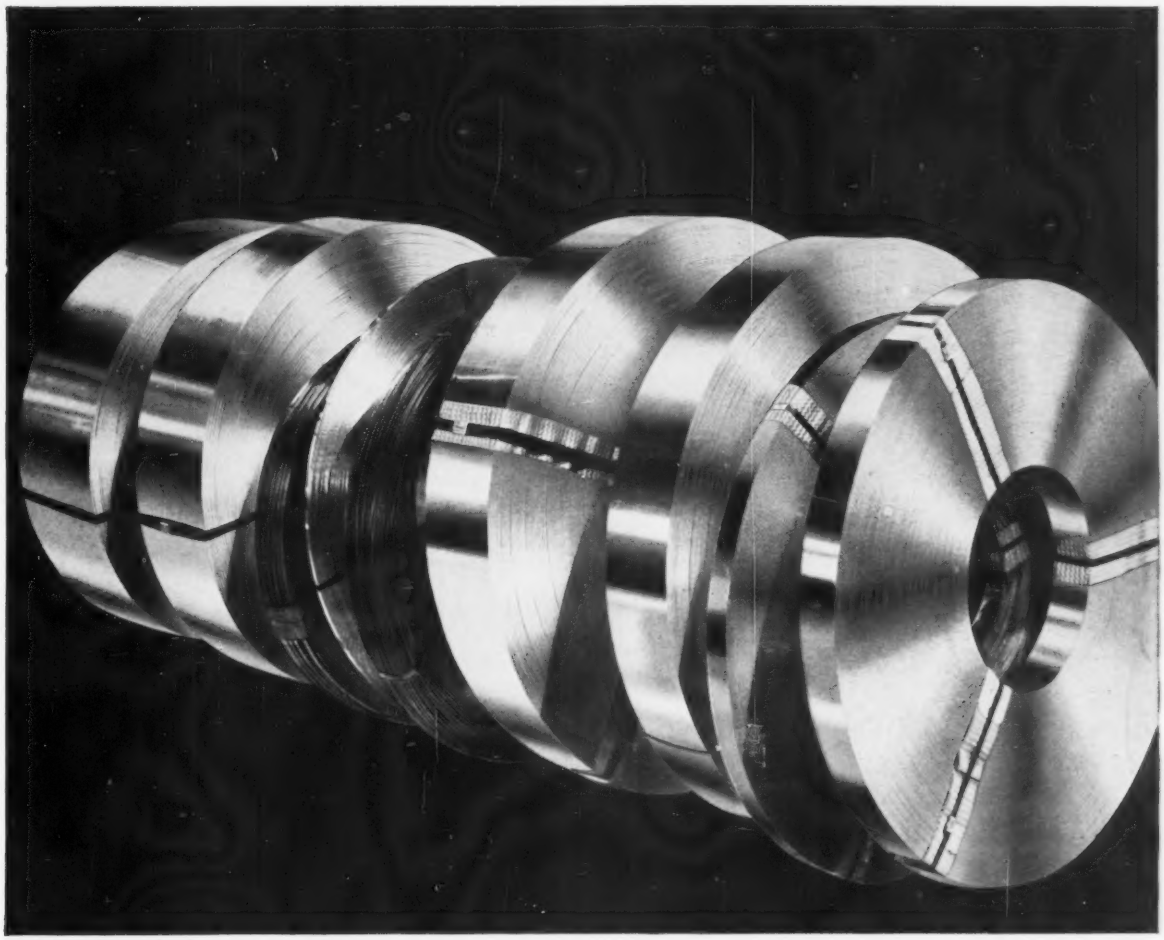
Chicago · Cleveland · Detroit · Houston · Los Angeles · New York · San Francisco · Tulsa

"Haynes" is a registered trade-mark of Union Carbide and Carbon Corporation



it's CRUCIBLE for the widest assortment of cold rolled specialty steels

Crucible has the largest assortment of cold rolled specialty steels you'll find anywhere. And delivery is dependable—in the size, grade, gauge, or analysis you want.

What's more, Crucible's steelmaking experience—its improved mill facilities—combine to bring you cold rolled steels of optimum uniformity . . . finer finish . . . better edges . . . flatter strip.

No need to shop around—call Crucible for carbon spring steel, alloy strip steel, or *any* ferrous analysis that can be cold rolled. For more information, write now for your copy of the 32-page booklet, "Cold Rolled Specialty Steels". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

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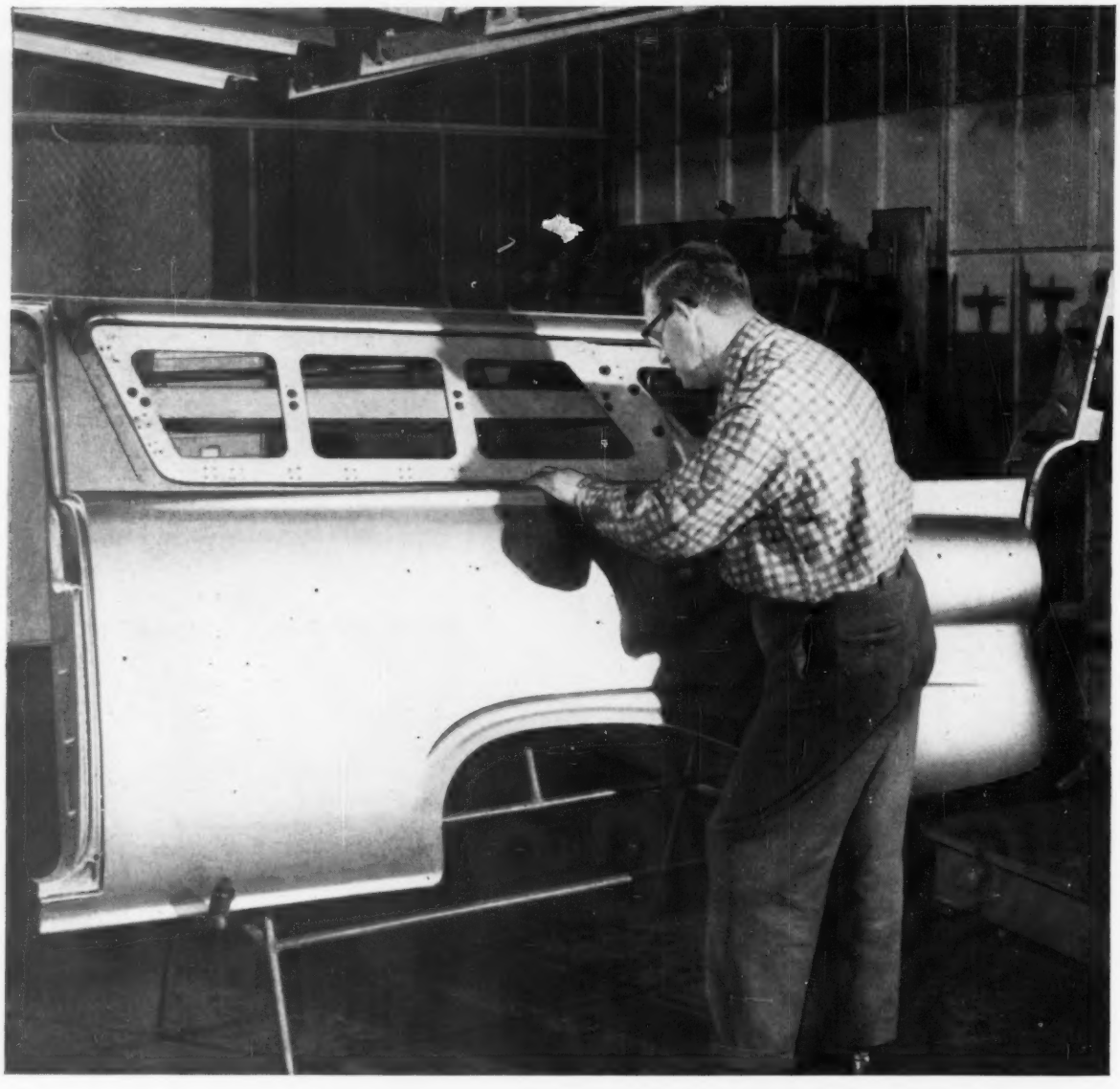

Lightweight magnesium fixture checks Ford station wagons

This magnesium checking fixture is used by Ford Motor Company in assembling Ford two-door station wagons.

It helps to maintain quality by checking the daylight opening relationship to the glass run channel and regulator retainer brackets in the quarter panel welded assembly. It assures accurate location of the glass run retainers and window regulator mounting holes. The fixture is dimensionally stable and has stood up well under continuous rough handling. One man can easily lift and manipulate it with one hand.

Jigs and fixtures made with magnesium are always easy to handle because they weigh much less than steel or aluminum. Magnesium tooling plate is uniformly flat, low in cost and easy to machine, fabricate and weld.

For the full story on magnesium tooling plate contact your nearest supplier of Dow magnesium or write to us.

THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1416Y.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill. Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

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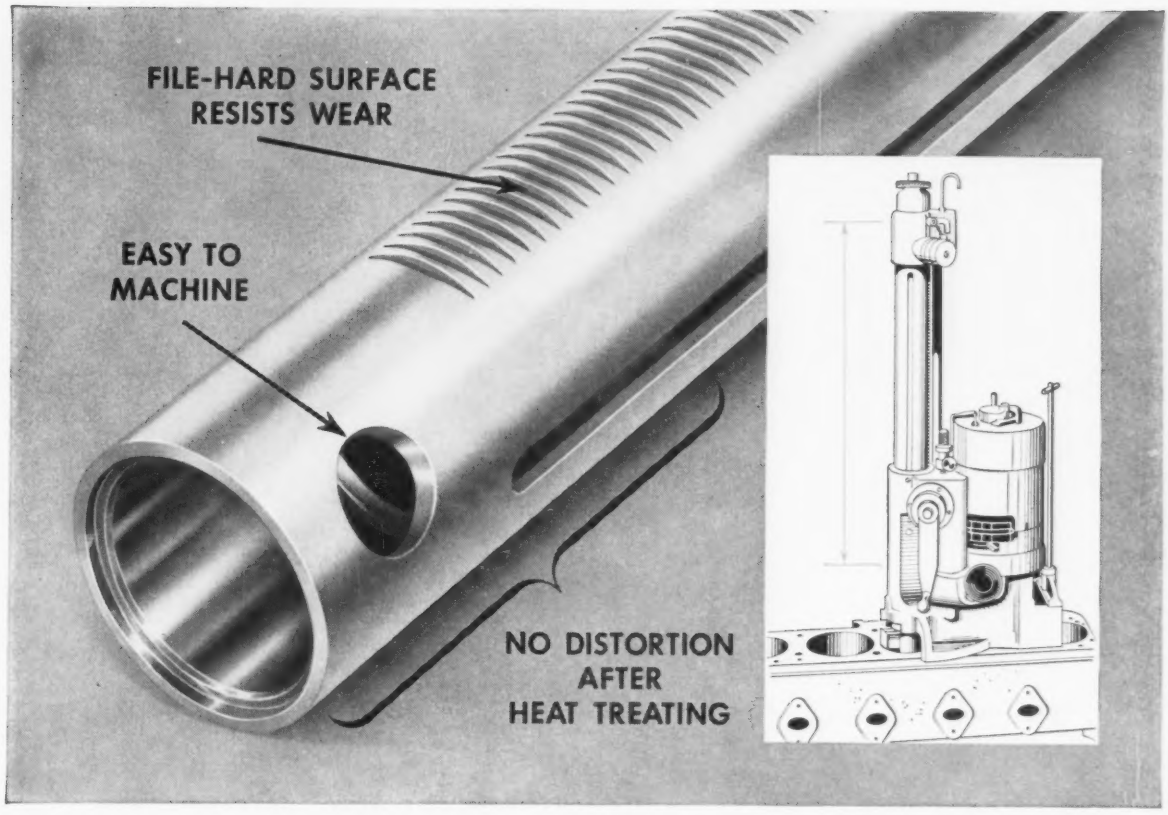

Boring bar maker solves heat-treat distortion problem by switching to TIMKEN® 52100 steel

HEAT-TREATING distortion was running up the manufacturing costs of the boring bars Van Norman Automotive Equipment Company makes for reboring hard-sleeve cylinder blocks. The column of the boring bar, which acts as the spindle, had to be extremely straight. Yet many of them were distorting after heat treatment. And that meant putting them through an extra straightening process.

Studying the problem, metallurgists of the Timken Company suggested a switch to Timken® 52100 steel. Since this steel is hard and tough, it had the qualities Van Norman wanted. And because it responds uniformly to heat treatment it proved to be the answer to their production problem.

By switching to Timken 52100 steel, Van Norman eliminated the need for the costly straightening operation. And as a bonus, they've found that Timken 52100 steel is easier to machine than the steel they previously used.

The Timken Company pioneered the development of 52100 and is one of the principal producers of the steel—the only source of the grade in three finished forms: bars, tubing and wire. You can rely on the Timken Company for small run or emergency requirements as well as mill quantities.

We stock 101 sizes of 52100 steel tubing, ranging from 1" to 10½" O.D. For a complete stock list of available sizes, grades and finishes, write The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

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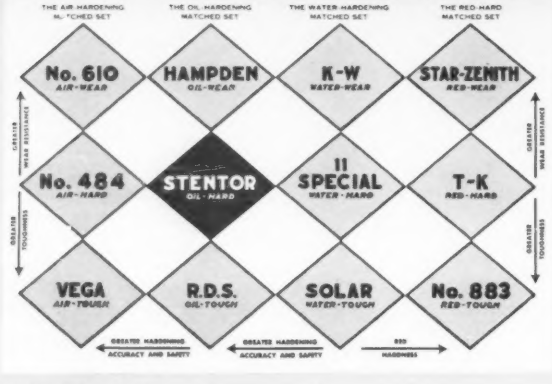
now

Once again, Carpenter Metallurgists prove their desire and ability to pace the field in developments you want and need!



Like all Carpenter Matched Tool and Die Steels every bar of STENTOR (Oil-Hard) is colored full length in its own distinctive color for quick, positive identification! Immediate availability from your local Carpenter Mill-Branch Warehouse, Office or Distributor.

® *U.S. Patent Office*

...*Carpenter* extends the built-in safety factor of STENTOR (oil-hard) tool and die steel!

Remarkable heat treating versatility . . .
safe, dependable hardening through a broad range of 1425°F to 1525°F

The many advantages which make STENTOR one of industry's most used and talked-about steels are affected in no way by this exclusive new development. Its simplified analysis remains unchanged. It is still the easiest and one of the *safest* oil-hardening steels to harden. Requires no preheating whatsoever. Hardens from a lower temperature. Assures you less size change and distortion . . . uniform hardenability . . . full freedom from decarburization . . . long, dependable service.

And NOW . . . an extended Built-In Safety Factor enables you to heat treat STENTOR tools, dies and parts either of two ways: (1) At temperatures as low as 1425°F for the cost savings this brings you . . . or (2) Place them right in the furnace with other tools that are heat treated at temperatures up to 1525°F, and eliminate special furnace runs.

If you are not already using Carpenter STENTOR, it's time to *re-evaluate* the *extra* advantages you get with this versatile die steel.

JUST PRINTED! For more facts on how you and your men can Step Ahead with STENTOR, drop us a line on your Company letterhead for this new descriptive folder.

Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 105 W. Bern St., Reading, Pa.
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

For more information fill in page number on Inquiry Card, on page 257

® U.S. Patent Office

HERE are TWO important advantages you get with Oakite Composition No. 98 in solvent spray washing:

1 ***Effectively cleans parts between machining operations***

2 ***Protects work against indoor rust***

OAKITE COMPOSITION No. 98—new emulsifiable solvent cleaner expressly designed for use in one and two-stage spray-washing equipment—safely removes light to moderate soils from all metals.

WHILE REMOVING THE SOIL, Oakite Composition No. 98 also gives machined parts a non-tacky film to protect them against indoor rust during temporary storage.

FOR REMOVING EXTRA HEAVY SOILS, Oakite Composition No. 98 may be used in combination with recommended Oakite alkaline detergent, using a two-stage pressure spray washer.

Read what enthusiastic users have to say about Oakite Composition No. 98. Then call your local Oakite Technical Service Representative for a demonstration of Oakite Composition No. 98. Or write for free descriptive booklet to Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

REMARKABLE RESULTS NOW OBTAINED BY ENTHUSIASTIC METAL FABRICATORS

Auto-maker washing blocks, cam shafts, tappets, wrist pins, transmission housings, fly wheels and other parts is delighted with the rust protection obtained.

Automotive plant turning out parts with highly finished surface reports use of Oakite Composition No. 98 not only cleans but also leaves a streak-free protective film so essential to quality control.

Metal fabricator finds that small precision steel parts are protected against rust for 3 to 4 weeks. The need for expensive fire prevention equipment—originally installed for use with low-flash rust-proofing oil—is eliminated.

Engine builder using Oakite Composition No. 98 in two-stage washer says not only are parts well cleaned but also protected against rust at unusually low cost.

Metal parts company washing parts by machine finds Oakite Composition No. 98 completely eliminates rusting in humid weather.

Manufacturing firm reports Oakite Composition No. 98 very economical. Parts come through clean and bright, no cloudy film—good rust protection.

Engine builder using Oakite Composition No. 98 after machining but prior to inspection and assembly expects five-day rust protection and gets it.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE®
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada

Export Division Cable Address: Oakite

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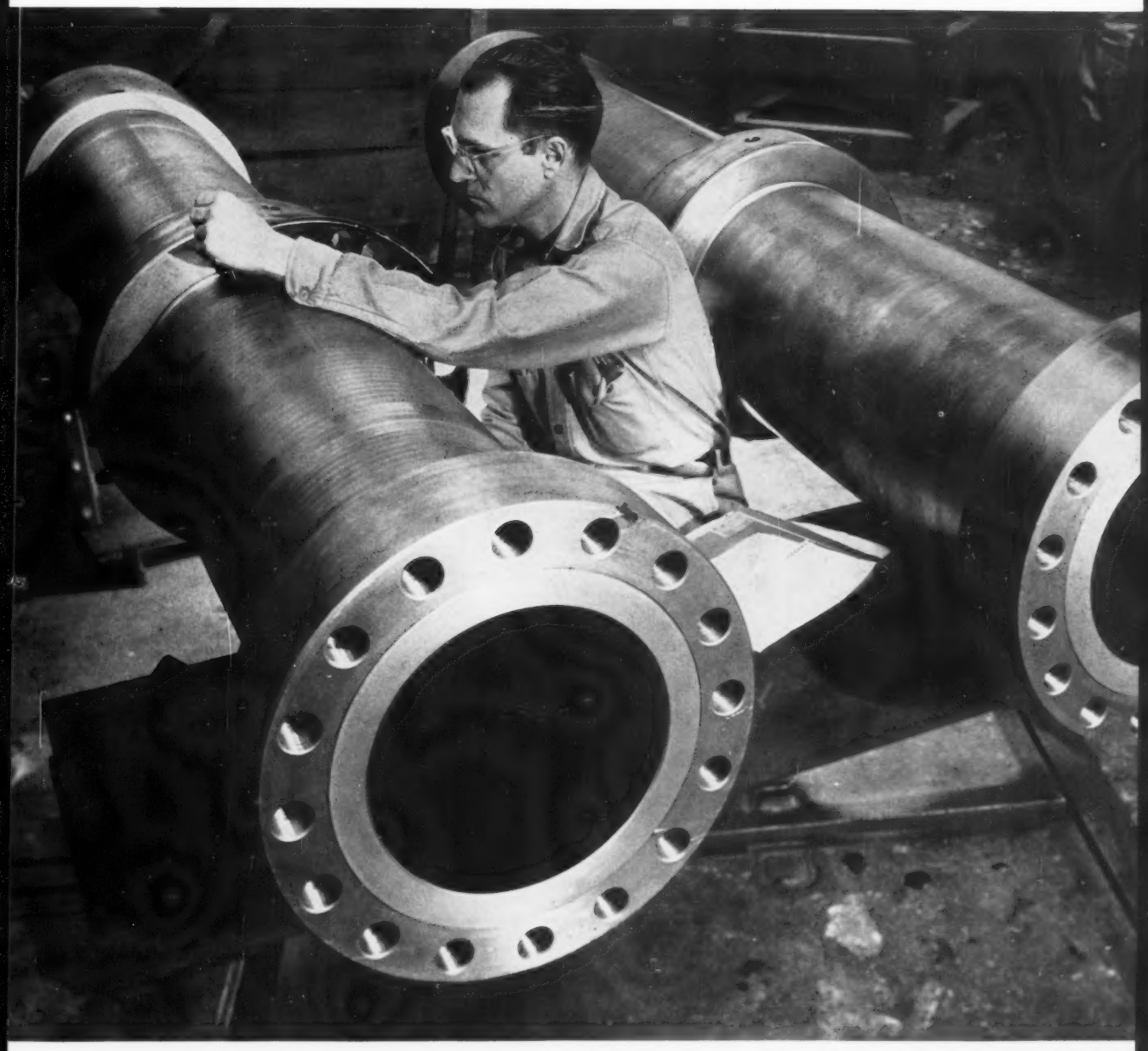


OD 15 in., Right on the Nose

That was one of the specifications: outside diameter, 15 in. Very little tolerance; had to be almost exact. And it was, when it came from the Bethlehem machine shops for checking. Right on the nose!

There were other interesting specs that applied to this Bethlehem forging, and its twin. The two pieces are return cylinders for an extrusion press. The buyer required that they be 100¼ in. long. Bore was to be 1 ft for a distance of 87½ in.; then 7¾ in. for the remainder of the length. Ticklish work? Sure! But Bethlehem machinists were equal to it.

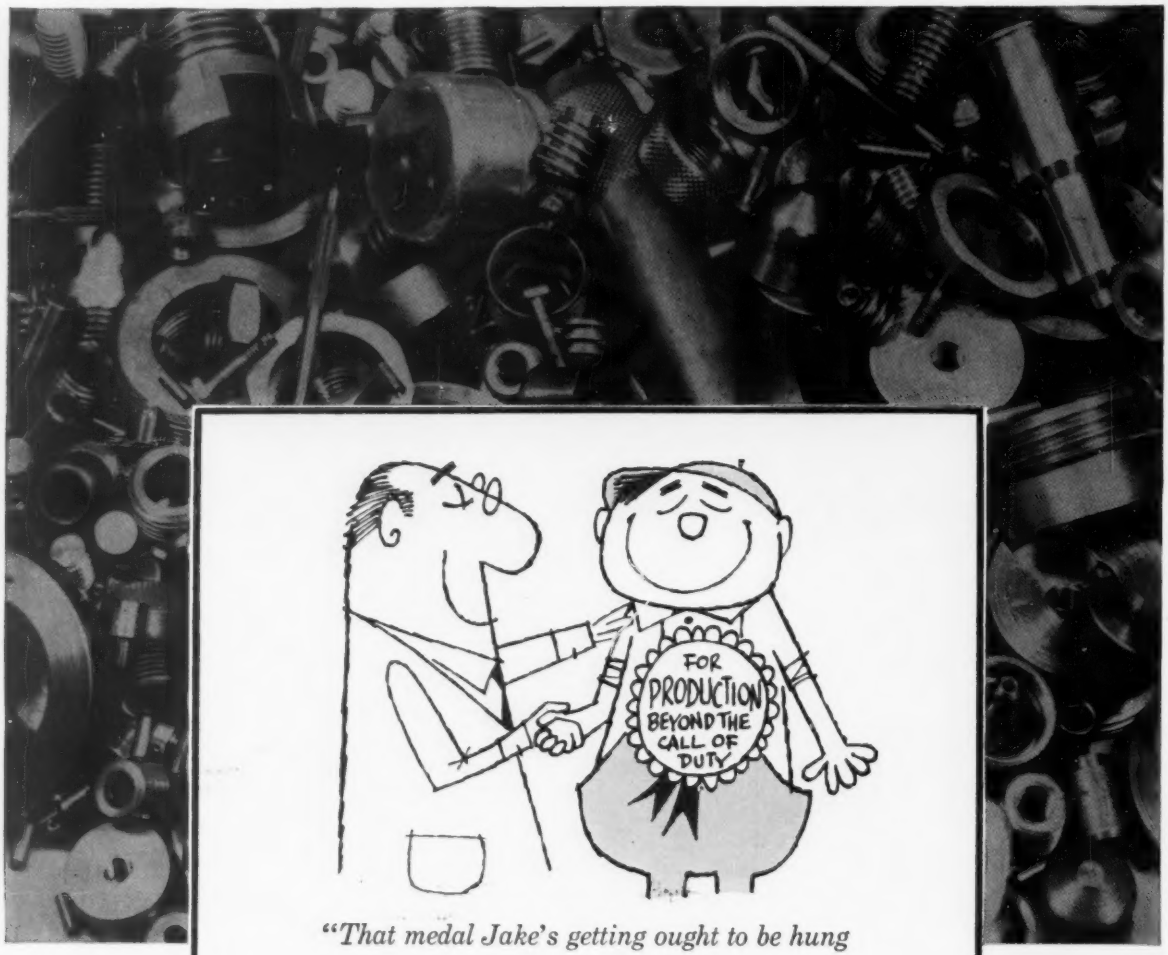
Bethlehem is recognized as a producer of forgings in all sizes—from the heaviest ever needed to pygmies weighing a pound or less. But we'd like to emphasize that Bethlehem services go beyond this point. The order described here is a good example. Whatever we forge, we can machine—and do a thoroughly expert job.

With its integrated set-up, Bethlehem is always able to handle your requirements. Call us when in the market for large or small forgings, and give us machining specifications. They'll be followed to the letter.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



"That medal Jake's getting ought to be hung on our stock of MX"

To hang up production records takes more than modern equipment and experienced operators. You've got to use screw stock that makes it possible for both to perform at top efficiency.

That's why so many shops have switched to USS Free-Machining MX Steel. With this faster-cutting screw stock, production increases of 50% or more are not unusual . . . tool life is extended, frequently doubled, and down-time is correspondingly reduced.

What's more, with MX on the job, screw machine parts are not only turned out in record time but, because MX is consistently uniform in cutting characteristics and in freedom from injurious imperfections, parts made with MX are *better* parts—better in finish, accurate in dimension and with fewer rejects to cut into profits.

USS Free-Machining MX Steel has been successfully machined at speeds up to 350 SFM—yet it costs no more than regular screw stock.

Based on results obtained in producing more than a billion parts of many different kinds and under widely different conditions, we feel sure that *MX will cut the cost of any part* you now machine from regular screw stock grades. Why not prove it for yourself?

Available both in Bessemer and Open Hearth grades, USS Free-Machining MX is produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest district office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

More parts . . . better parts . . . at lower cost per part

—when you do the job with free-machining

MX

USS

UNITED STATES STEEL

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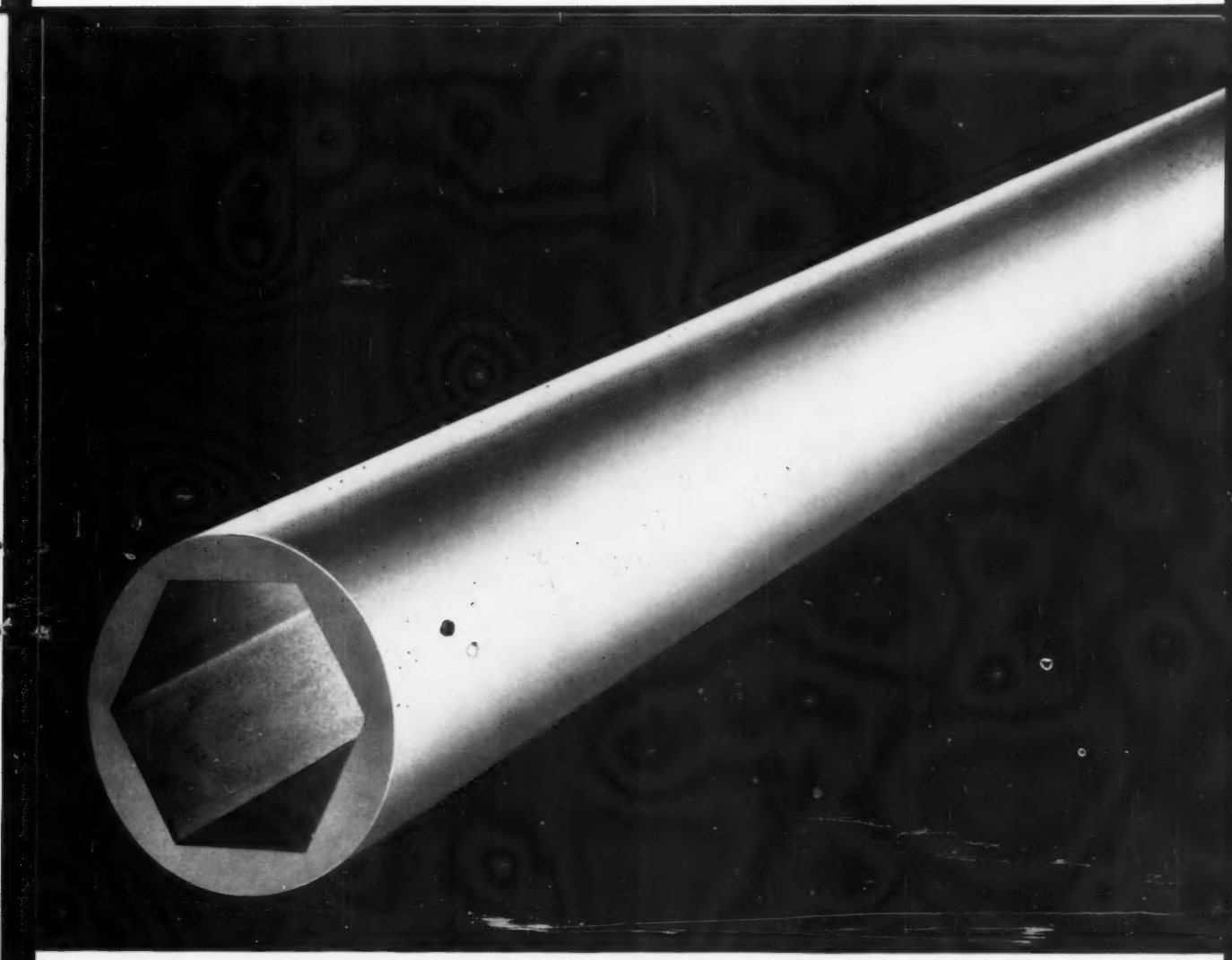


EVER TRIED MACHINING A SPECIAL I.D. SHAPE?

—in stainless steel, with each part 22 inches long, the outside diameter a shade over 2 inches and with tolerances of +.000" to —.010" across the flats?

On jobs like this, there's possible trouble ahead if you start with solid stock, or even round heavy wall tubing. Machining problems, surface finishing, scrap loss, special cutting oils or compounds—added to the original stock cost may make the final cost of the part prohibitive.

There is one sure way of minimizing your production problems and costs involving hollow cylindrical parts and products—*DESIGN WITH B&W MECHANICAL TUBING.*

Before you start your next production run, call Mr. Tubes at your nearby B&W Tubular Products Division District Sales Office—let him match tubing steels, types, finishes, shapes and tolerances to your applications—he will show you how to keep final costs low. Or write for bulletins 361 and 340. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-6086-M2

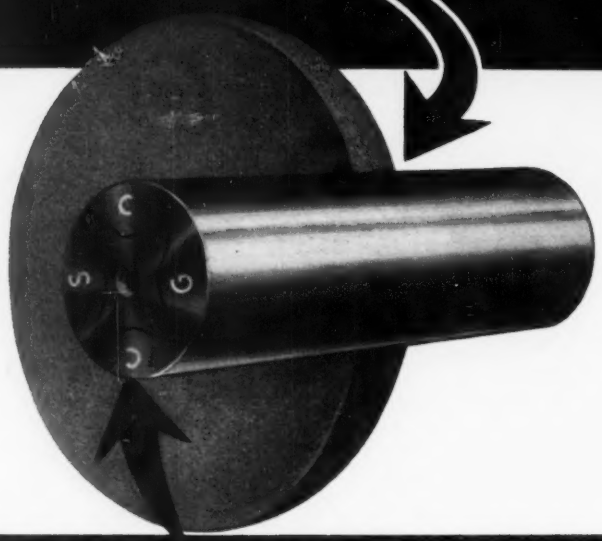
Seamless and welded tubular products, seamless welded fittings and forged steel flanges—in carbon, alloy and stainless steels.

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

For more information fill in page number on Inquiry Card, on page 257

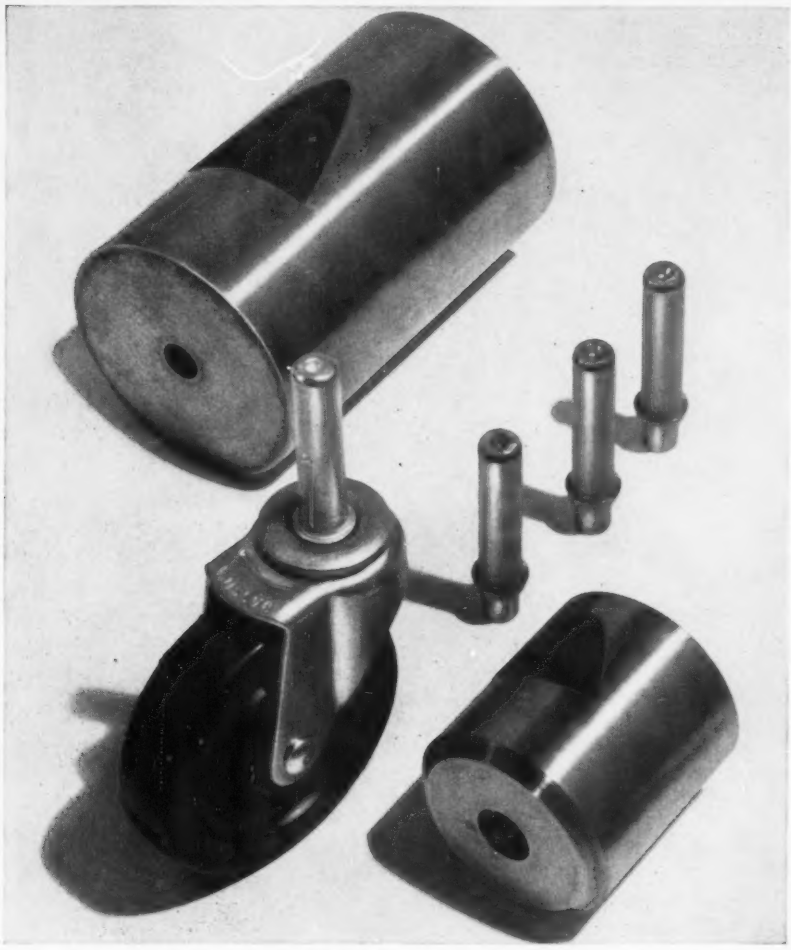
Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Maker of Casters Gets Good Results with Water-Hardening Steel

The Bassick Company, Bridgeport, Conn., a leading manufacturer of casters, needed a good grade of tool steel for the dies and punches used in producing caster stems. They took the problem to Lindquist Steels, Inc., their local tool-steel distributor, who recommended Bethlehem W-1 Carbon Water-Hardening tool steel for cold-heading purposes. The performance of this grade, with its controlled hardenability, has been excellent.

The dies and punches, some of which are illustrated above, are hardened to about Rockwell C-60, and work on Bethlehem Cold-Heading Wire. They have proved economical, as their service life is approximately 100,000 pieces.

Bethlehem Carbon Water-Hardening tool steel has high shock-resistance because it is carefully controlled for hardenability. Besides, with its controlled carbon range, it has good resistance to wear, plus the toughness to withstand cold battering.

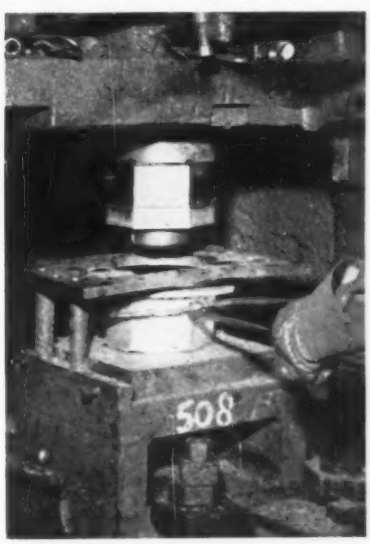
There may be one or more applications in your shop where Bethlehem Carbon Water-Hardening tool steel could be used to advantage. Why not talk it over with your Bethlehem tool steel distributor?

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Bend Tool Steels While They're Hot

The structure of machinery is such that parts are sometimes fabricated of steel which has been cold-bent to shape. However, when some of the components are made of tool steel, bending usually cannot be done at room temperature without causing breakage. Some degree of heating must therefore be employed.

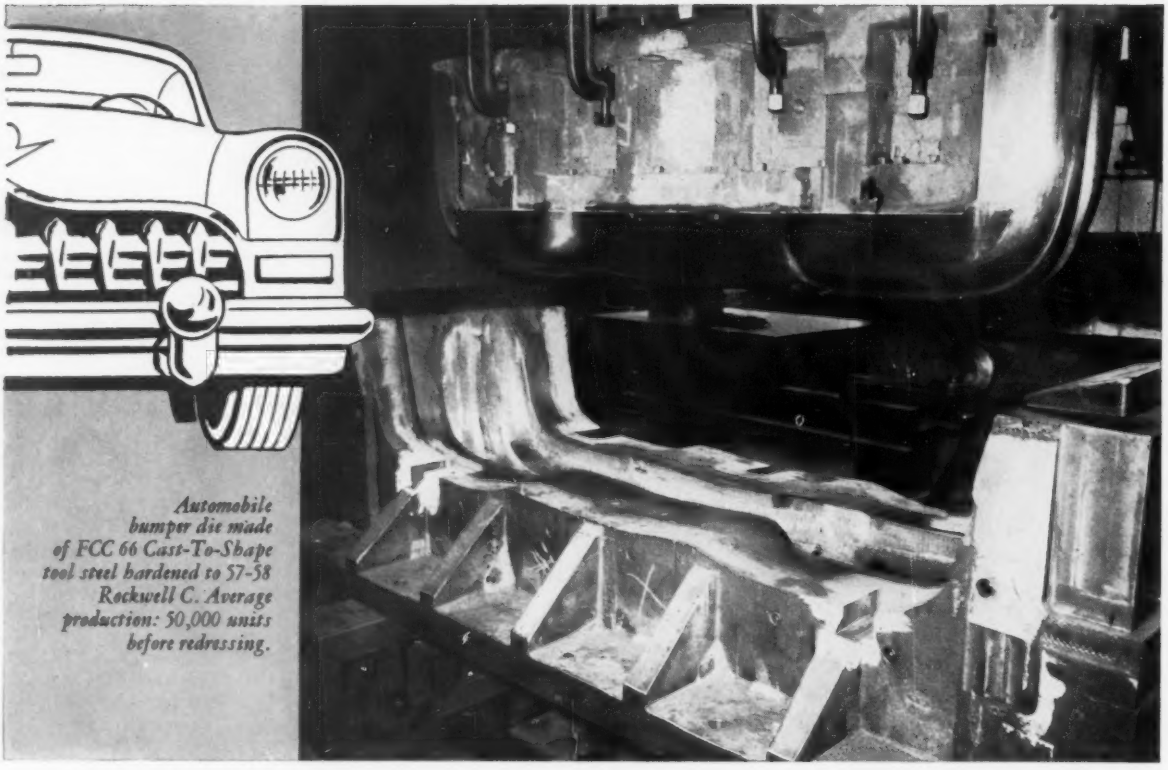
For severe bending, such as bending to a small diameter, the tool steel is usually heated to the full forging temperature. Depending upon the grade, this may be 2000 F or higher. Moderate bending (curving into a shape similar to a leaf spring) can take place after heating to about 1300 F, being careful that the maximum temperature reached does not exceed the critical temperature. Very light bending operations (perhaps bending a shear blade to compensate for expected warpage in heat-treatment) can be accomplished at room temperature if a generous radius of curvature is used.



Making 36-lb Nut Behave

Here is a shaving die, made of Lehigh H tool steel, used in hot-broaching the sides of a $4\frac{1}{4}$-in. hexagon nut. Lehigh H is our special-purpose high-carbon, high-chromium grade of tool steel. Its excellent wear-resistance and red hardness make it an ideal steel for this application.

Try this money-saving method that auto-makers use



Automobile bumper die made of FCC 66 Cast-To-Shape tool steel hardened to 57-58 Rockwell C. Average production: 50,000 units before redressing.

A-L CAST-TO-SHAPE TOOL STEELS

SEND FOR THIS NEW CATALOG
"FORGING AND CASTING PRODUCTS"

Contains the latest information on FCC Air Hardening, Oil Hardening and other Cast-To-Shape Tool Steel Specialties that can save you time and money . . . also Composite Die Sections and Smooth Hammered Forgings in a wide range of tool and stainless steels. *Don't wait—get your copy NOW.*

Write Today

ADDRESS DEPT. M-87

Auto makers, too, are included in the long list of manufacturers enjoying the advantages and economies of A-L Cast-To-Shape tool steels. By this modern, money-saving method of tool and die making, it is possible to cast even intricate shapes to within an eighth of an inch of finished size. The savings in time and material over that of machining from solid stock are readily apparent.

A-L Cast-To-Shape tool steels are offered in a variety of grades, and are electrically melted to precise laboratory standards. They are remarkably resistant to abrasion and possess great compressive strength. In many cases, they out-perform tools and dies made from solid bars and forgings.

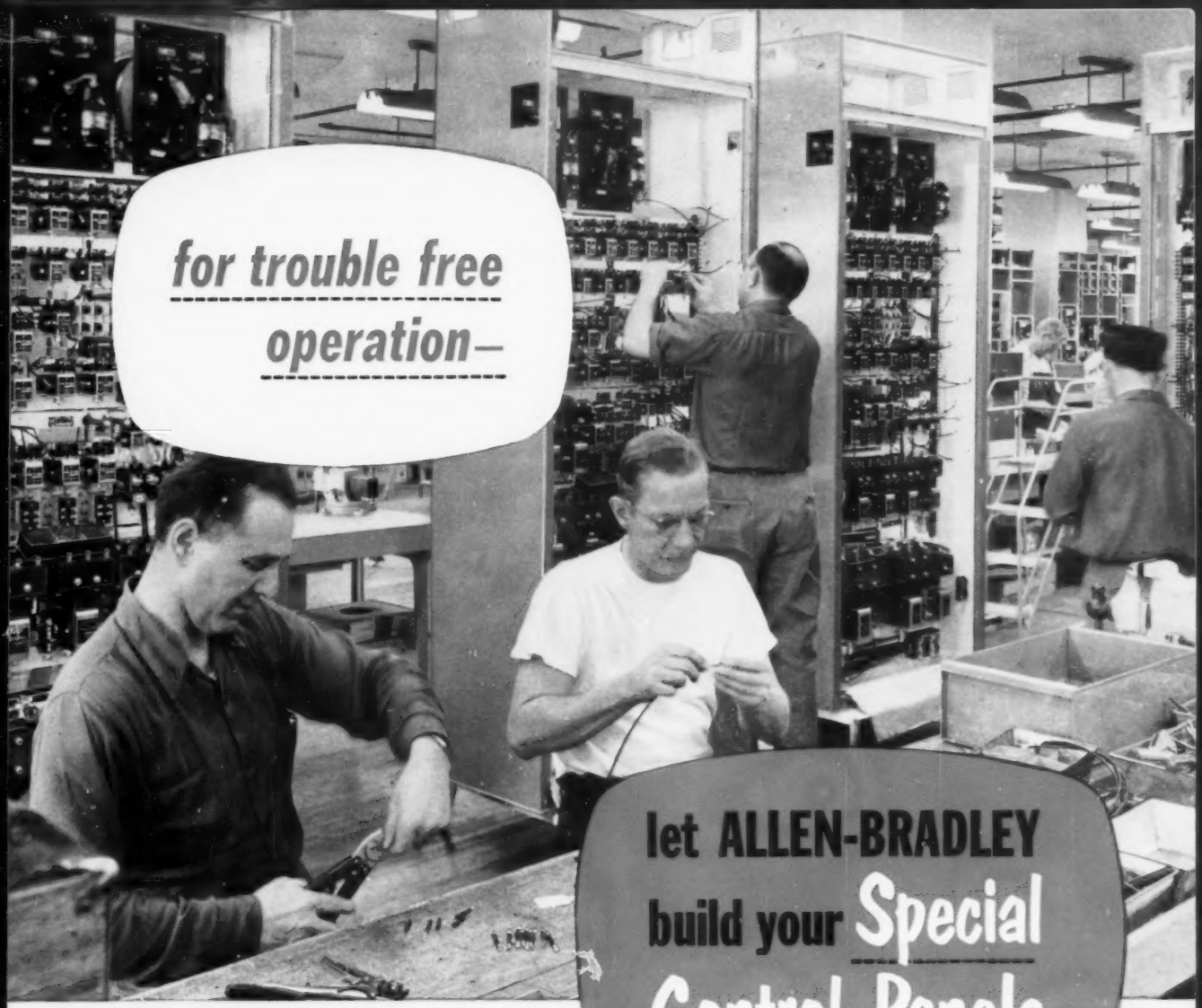
Remember, with A-L Cast-To-Shape tool steels, you buy less steel originally, and you have less machining to do for finish. Ask your A-L representative about them TODAY . . . or write *Allegheny Ludlum Steel Corporation, Forging and Casting Division, Wanda and Jarvis Avenues, Detroit 20, Michigan.*

For complete MODERN Tooling, call

Allegheny Ludlum

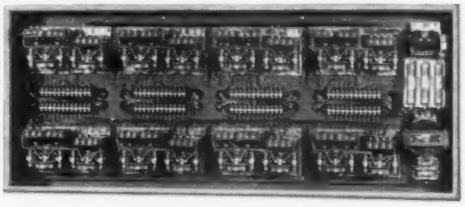
AL® FINE TOOL STEELS SINCE 1854

WSW 6078

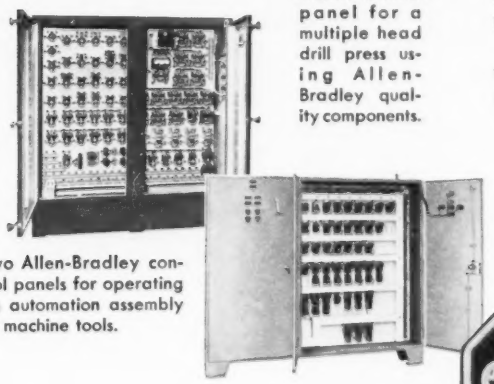


for trouble free operation—

let ALLEN-BRADLEY build your Special Control Panels



Motor control panel for a multiple head drill press using Allen-Bradley quality components.



Two Allen-Bradley control panels for operating an automation assembly of machine tools.

When the control panel furnished with your production machine carries the Allen-Bradley trademark of QUALITY, your customer's approval is assured! That is why so many leading machinery builders have standardized on Allen-Bradley controls. The "simple design" of all Allen-Bradley controls is your guarantee of trouble and maintenance free service.

No matter how complex your control requirements may be, as specialists in this field, Allen-Bradley's experience may be of valuable assistance to you. Call your nearest A-B office.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY

QUALITY

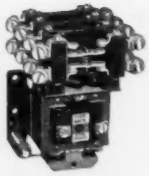
MOTOR CONTROL

A-B Quality

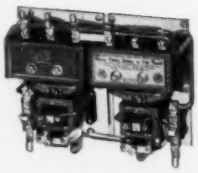
3-57-R

"we'll use ALLEN-BRADLEY Quality Motor Control ...it's trouble free!"

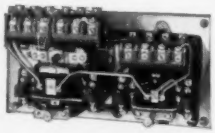
SPECIFY THESE RELIABLE MOTOR CONTROL UNITS



Bulletin 700
Universal Relay with
N.O.—N.C. Contacts



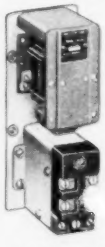
Bulletin 705 Size 2
Reversing Starter



Bulletin 715 Two
Speed Consequent
Pole Starter

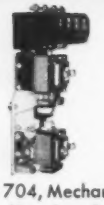
Bulletin 802T Adjustable
Lever Oiltight Limit
Switch

Bulletin 702 Three Pole
Size 2 Contactor



Bulletin 849 "On-Delay"
Pneumatic Timer

Bulletin 892
Handy Terminal
Blocks

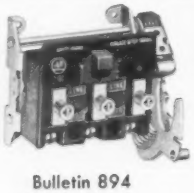


Bulletin 704, Mechanically
Held, Hum-free Relay

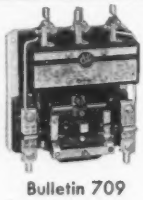
Bulletin 200
D-C Relay

Bulletin 350
Reversing Drum Switch

Bulletin 836
Pressure Control in
NEMA Type 4 Enclosure



Bulletin 894
Visible Blade
Disconnect Switch



Bulletin 709
Size 4 Automatic
Starter

Bulletin 609
Three Phase
Manual Starter

Oiltight Push Button, Selector Switch, Press-to-Test
Pilot Light, and completely assembled Oiltight Station

Allen-Bradley *quality* components assure you millions of trouble free operations. The simple design, maintenance free, double break, silver alloy contacts, and rugged design features have made them the first choice among design engineers, contractors, and maintenance men. You just can't go wrong with this QUALITY line.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

Send for your copy of the new 7th edition of the Allen-Bradley Handy Catalog

3-57-MR

Vibration won't loosen FLEXLOC self-locking nuts

Where products must be reliable . . . must stand up under vibration, temperature extremes and hard use . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts.

HERE'S WHY:

FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting locking action. And they are reusable: repeated removal and replacement, frequent adjustments, even rough screw threads will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes, types and materials to meet the most critical locknut requirements. Your local industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

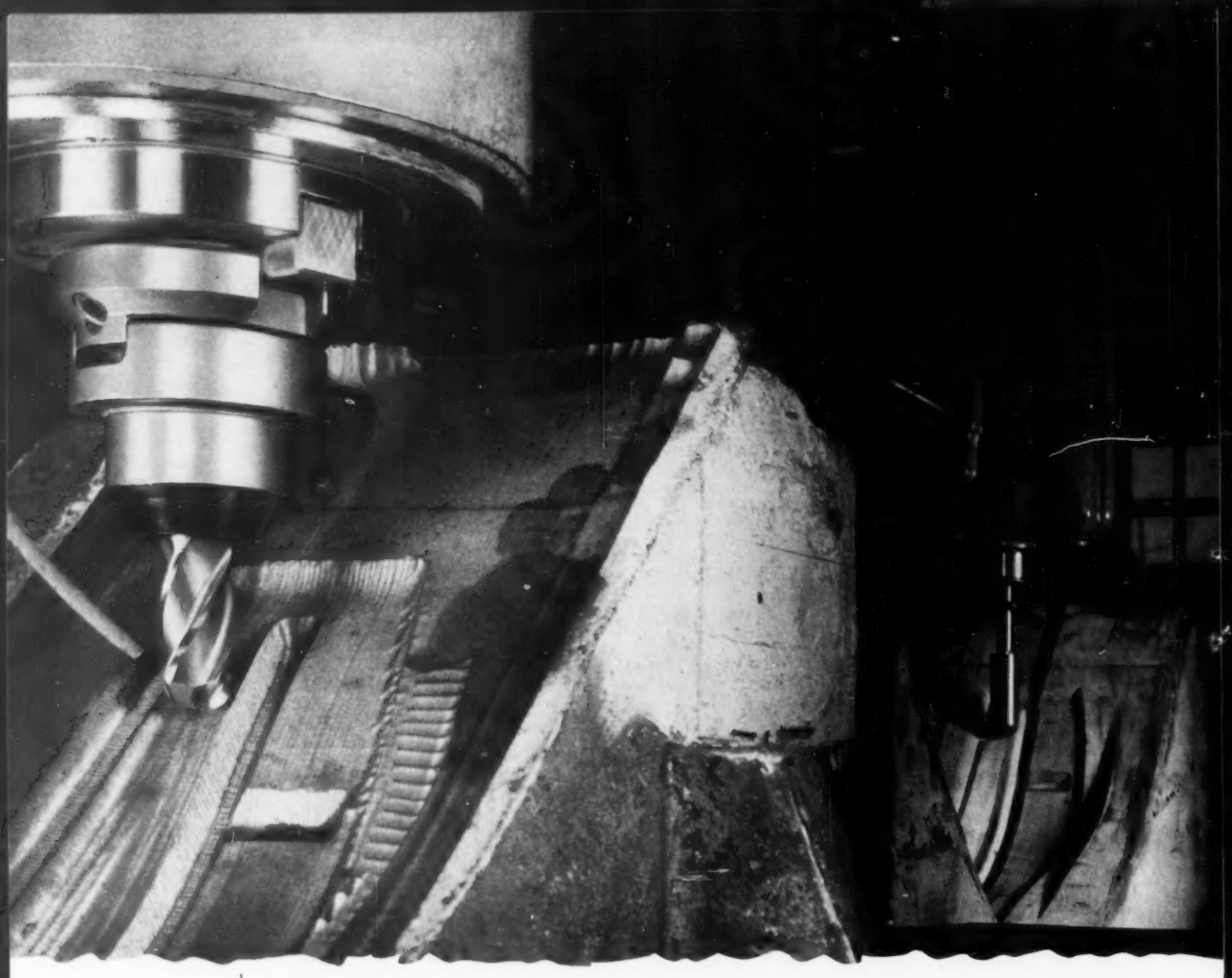
FLEXLOC® LOCKNUT DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

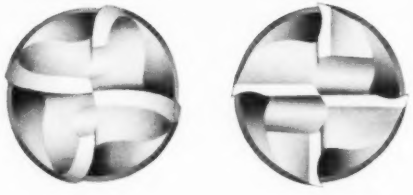
For more information fill in page number on Inquiry Card, on page 257



EFFICIENT MILLING...*in any direction!*

New CLEVELAND 4-flute center cutting End Mills reduce individual end tooth shock and assure smoother cutting action, particularly in plunge milling.

The advanced design of 4-flute 500 Series High Speed End Mills is your assurance of *accuracy* and *high production* in both tracer and general purpose milling. The accurately form-ground notches and the precision ground cutting edges give you absolute uniformity and *positive chip removal.* Try these new CLEVELAND End Mills on your next job. Get all the advantages of 4-flute mills *and plunge cutting, too!* Contact our nearest Stockroom, or . . .



BALL NOSE SQUARE END

In both the ball nose and square end types, the rake angle is uniformly progressive from zero at dead center to blend with the hook in the cutting face of the flutes.

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

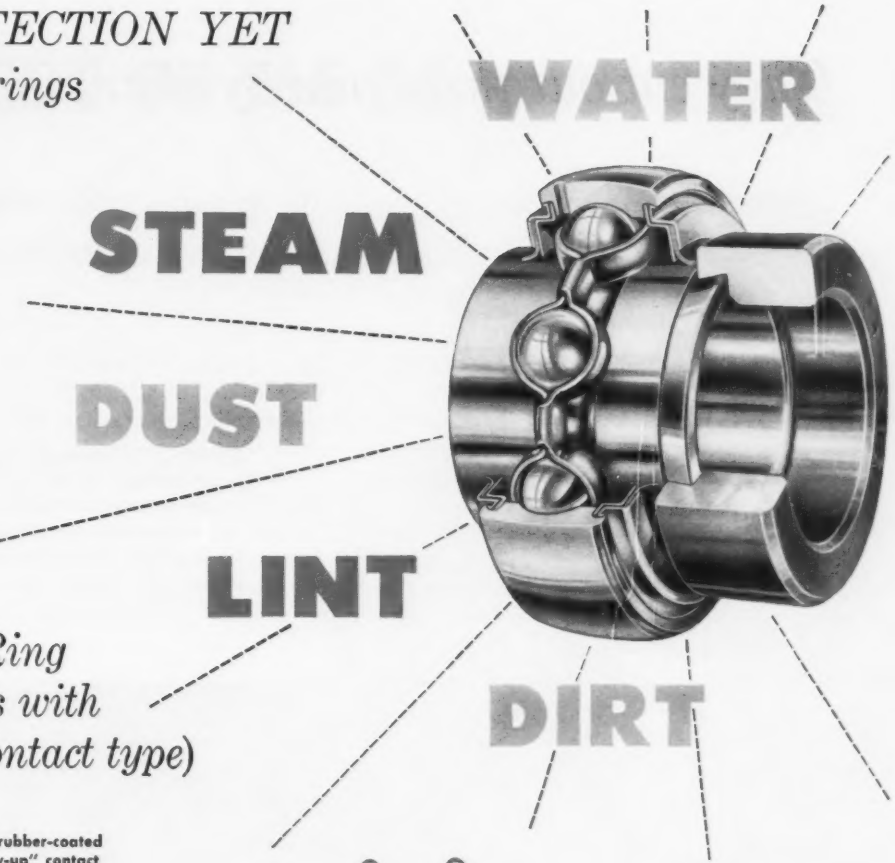
THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

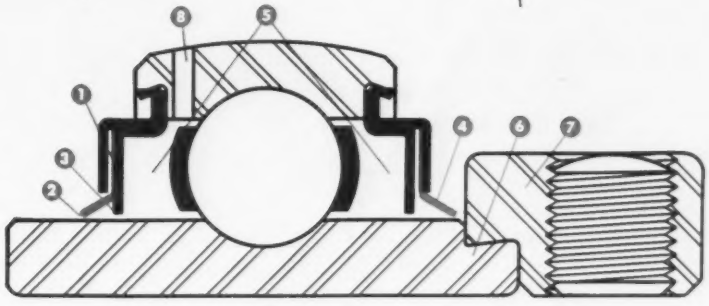
BEST PROTECTION YET
for Ball Bearings
exposed to



FAFNIR
Wide Inner Ring
Ball Bearings with
Plya-Seals (contact type)

FEATURES

1. Plya-Seal of resilient Buna N rubber-coated fabric insuring proper "follow-up" contact
2. Seal rides in firm contact on ground outside diameter of inner ring
3. Close-clearance of inside metal shield with outside diameter of inner ring provides rigid support for seal
4. Flared lip of Plya-Seal won't push in
5. Generous space for lubricant
6. Wide inner ring for extra shaft support
7. Fafnir-originated self-locking, eccentric-cam-design collar
8. Relubricatable

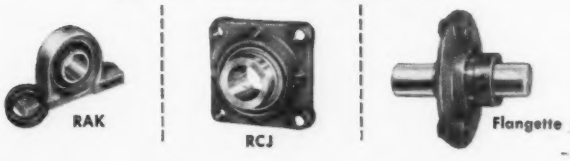


On slow to moderate speed applications where service conditions are subject to excessive contamination, Fafnir Plya-Seal equipped Wide Inner Ring Ball Bearings fill a definite need. Their laboratory and field-tested performance offers the proven protection of contact-type Plya-Seals. They provide every advantage of Fafnir Wide Inner Ring Ball Bearings with Self-Locking Collars . . . ease of application, positive locking, extra large support area on the shaft, relubricatable or nonrelubricatable, self-alignments.

The Plya-Seal as incorporated in the Fafnir Wide Inner Ring Bearing consists of two steel plates between which is sandwiched a synthetic rubber-coated fabric sealing washer. Both steel plates are fixed securely in an outer ring groove. The inner plate provides a rigid backing for the seal and a close-clearance baffle for the retention of grease.

This recent addition to the Fafnir Line is dimensionally interchangeable with the Fafnir Wide Inner Ring Ball Bearings equipped with Mechani-Seals. All types are prelubricated at the factory. Write for descriptive bulletin. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR WIDE INNER RING BALL BEARING WITH PLYA-SEALS AVAILABLE IN UNITS BELOW



FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

For more information fill in page number on Inquiry Card, on page 257

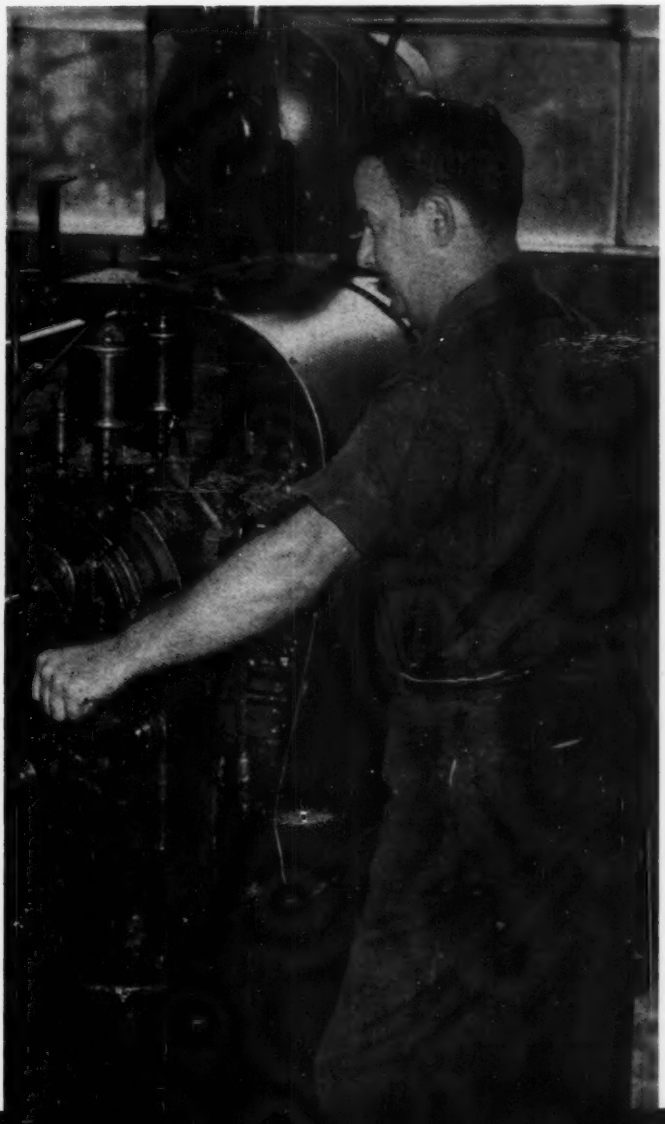
They cut out three oils by changing to one...

Standard Oil lubrication specialist Bob Cleland and plant manager I. G. Smallegan inspect work furnished by operator Dick Stockwell. Giving technical help to customers like this is something for which Bob Cleland is well fitted. Bob has a mechanical engineering degree from Michigan State and has completed the Standard Oil Sales Engineering School.

STANICUT Oil 166 BC

Screw machine plant saves on oil inventory and handling, receives other benefits by converting to dual-purpose cutting oil.

Grand Rapids Metal Products Company's problem was the mixing of cutting and lubricating oils in their National Acme and Gridley screw machines. In all, four oils were used. In some machines a cutting oil, two lubricating oils and a base oil were employed to improve machining characteristics. Lubricating oil leaking past seals mixed with the cutting oil, reducing cutting oil qualities. Oil mixtures were constantly varying, and troubles in tapping resulted.



Standard Oil's Bob Cleland, working with plant management, suggested STANICUT Oil 166 BC. This oil, he explained, is a dual-purpose oil. It can be used for lubrication as well as for cutting, and no dilution of the cutting oil can occur.

After a week's trial in one machine, the entire plant was converted to STANICUT Oil 166 BC. Tap troubles were reduced, resulting in much less down time. Spindle speeds have been increased, yet the spindles run cool. Oil inventories have been reduced from four to one.

STANICUT Oil 166 BC does not corrode bearings, gears, bushings, spindles or other machine parts. While STANICUT Oil 166 BC contains E.P. additives, it does not stain copper or brass.

Get the facts on how STANICUT Oil 166 BC can help you. Call the Standard Oil office nearest you anywhere in 15 Midwest and Rocky Mountain states. Or write to Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Quick facts about
STANICUT OIL 166 BC

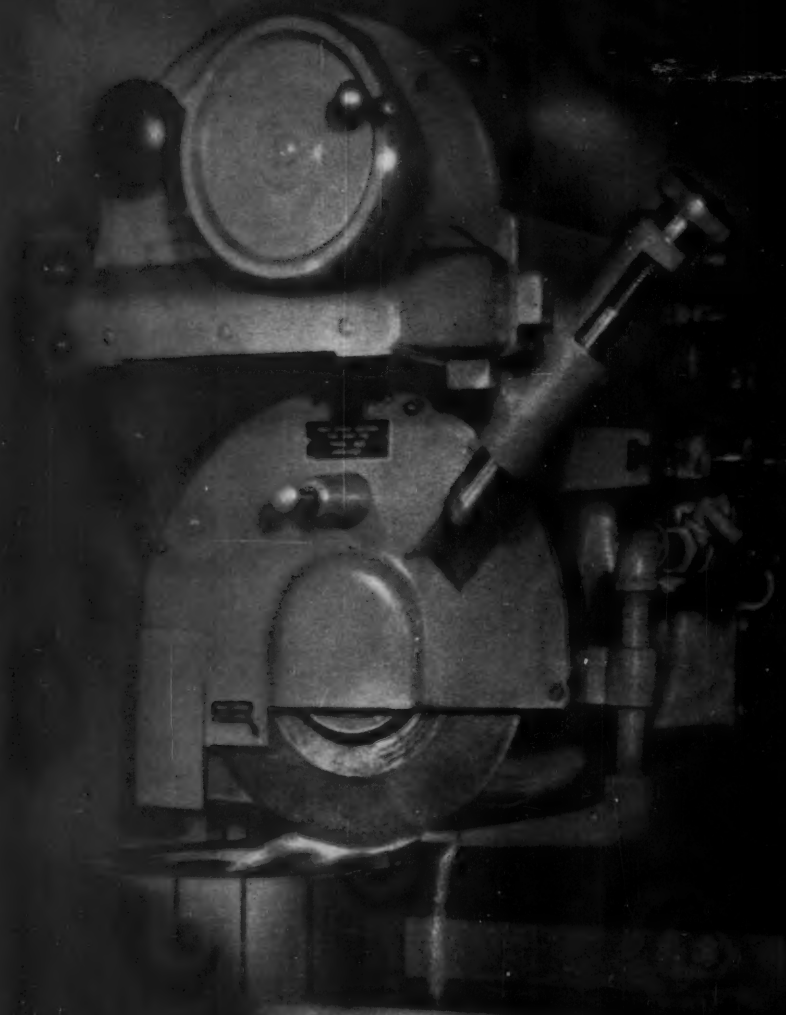
1	A dual-purpose oil – suitable for both cutting and lubrication.
2	Non-corrosive to work or machines.
3	Formulated with E.P. additives.
4	Stable under all normal conditions.
5	Non-irritating.
6	A cutting oil that permits high operating speeds.
7	Non-staining to either copper or brass.

STANDARD

STANDARD OIL COMPANY
(Indiana)

WORLD'S MOST COMPLETE LINE

# of hydraulic surface grinders



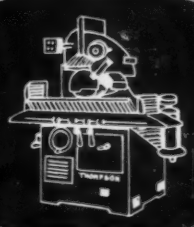
invites your attention...

name the surface grinding job... Thompson has the machine

Thompson Type B

Surface dies or parts faster to part print, at lower cost, within wide size range

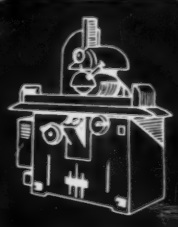
work size
6″ x 18″
to
12″ x 120″



Thompson Type F

For greatest precision, sensitivity and versatility in toolroom...or parts production at low cost

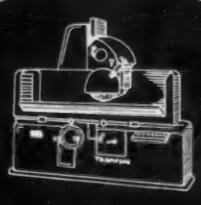
work size
8″ x 18″
and
8″ x 24″



Thompson Type C

Meets production and cost demands in larger size surface work of all types

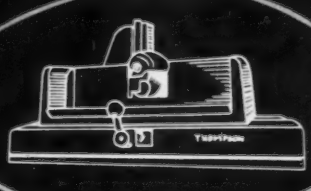
work size
12″ x 40″
to
24″ x 168″



Thompson Type CX

Offers both power and precision for heavy duty production...fast, accurate

work size
30″ x 72″
to
36″ x 240″



Thompson SURFACE Grinders

★ Including a complete line of Truform, Hydrail, Hydrovert, Twin Rotary and other special grinders for all sizes and types of work.

write for descriptive data

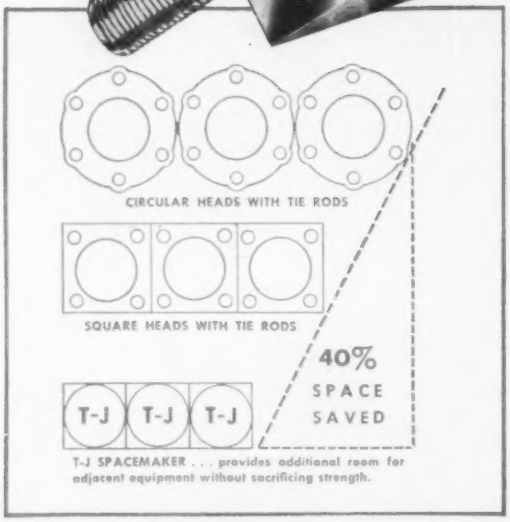
THE THOMPSON GRINDER COMPANY
SPRINGFIELD, OHIO

Copyright 1956 The Thompson Grinder Company

Saves 40% Space!

STRONGER, TOO

Than Outmoded Tie Rod Cylinders!



T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

Only T-J Spacemaker CYLINDERS

Offer All The Extras As Standard!

- **NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion**
- **Compact design eliminates tie rods, saves up to 40% space**
- **Proven Performance . . . with Extra High Safety Factor**
- **Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost).**
- **OIL pressure to 750—AIR to 200 P.S.I.**

You'll find many answers to *automation* in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Michigan.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

T-J TOMKINS-JOHNSON

RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHERS

For more information fill in page number on Inquiry Card, on page 257

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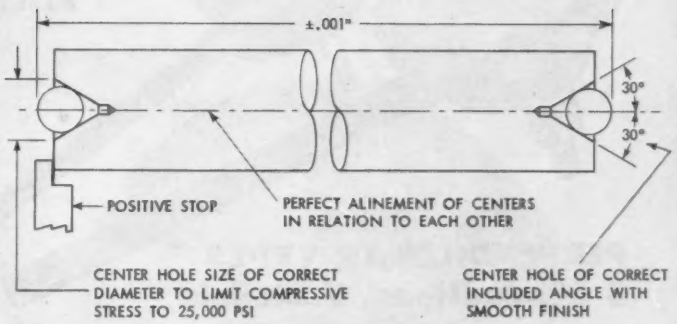
CENTERING IS CRITICAL

FOR TRACER AND AUTOMATIC LATHE PRODUCTION


±.001"
30°
30°
POSITIVE STOP
PERFECT ALINEMENT OF CENTERS IN RELATION TO EACH OTHER
CENTER HOLE SIZE OF CORRECT DIAMETER TO LIMIT COMPRESSIVE STRESS TO 25,000 PSI
CENTER HOLE OF CORRECT INCLUDED ANGLE WITH SMOOTH FINISH

The above sketch graphically highlights the centering "musts" for work to be automatically machined between centers.

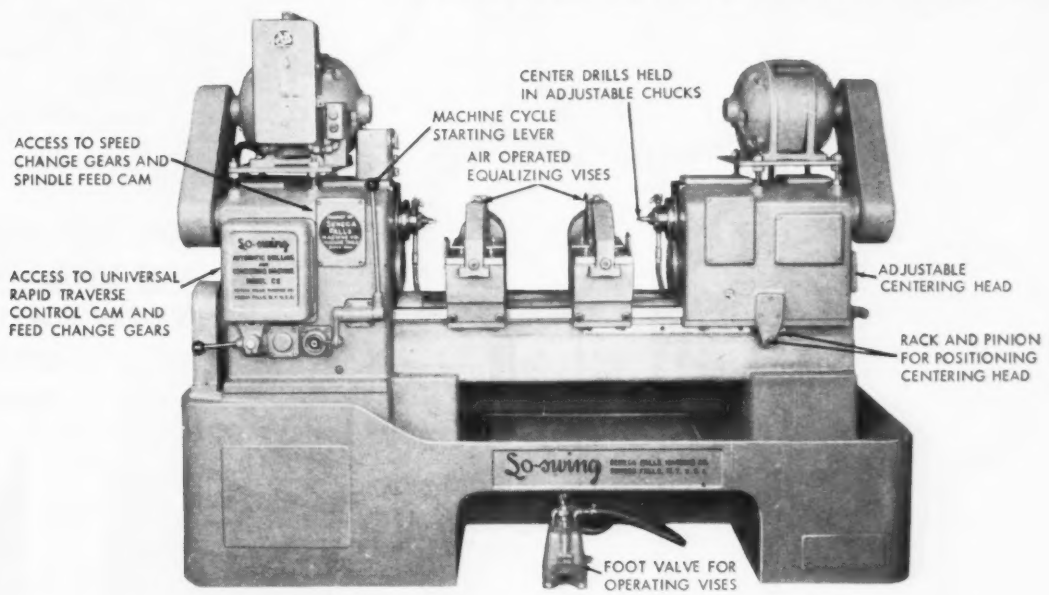
Model CS Lo-swing Automatic Drilling and Centering Machine has the inbuilt features to provide all these requisites. It is designed for accurate centering on a continuous, high production basis, yet can be quickly and easily "changed-over" for short run jobs. Its 100% mechanical system provides positive, independent control of rapid traverse movements and drilling feeds. It has a fully automatic cycle and can be completely automated in a production line.

Write for your copy of Bulletin CS-54 which tells the whole story.

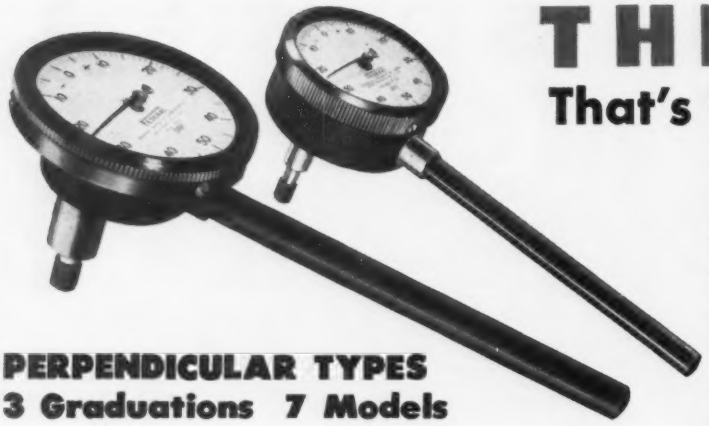
THIS IS WHAT MODEL CS WILL DO TO CUT COSTS ON TRACER AND AUTOMATIC LATHE PRODUCTION

- provide positive control of center depth to ± .001".
- accurately locate work piece to assure correct center depth at *both* ends.
- guarantee correct angle and perfect alinement of center holes.
- produce a smooth, cleanly-finished center hole capable of positive contact with the surface of the center. This is accomplished by a unique design of the feed cam which withdraws the center drill near the end of the feed stroke to clear chips . . . and then feeds a few thousandths at reduced rate for a final finish cut.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.


CENTER DRILLS HELD IN ADJUSTABLE CHUCKS
MACHINE CYCLE STARTING LEVER
AIR OPERATED EQUALIZING VISES
ACCESS TO SPEED CHANGE GEARS AND SPINDLE FEED CAM
ACCESS TO UNIVERSAL RAPID TRAVERSE CONTROL CAM AND FEED CHANGE GEARS
ADJUSTABLE CENTERING HEAD
RACK AND PINION FOR POSITIONING CENTERING HEAD
Lo-swing
FOOT VALVE FOR OPERATING VISES

Lo-swing MODEL CS AUTOMATIC CENTERING MACHINE



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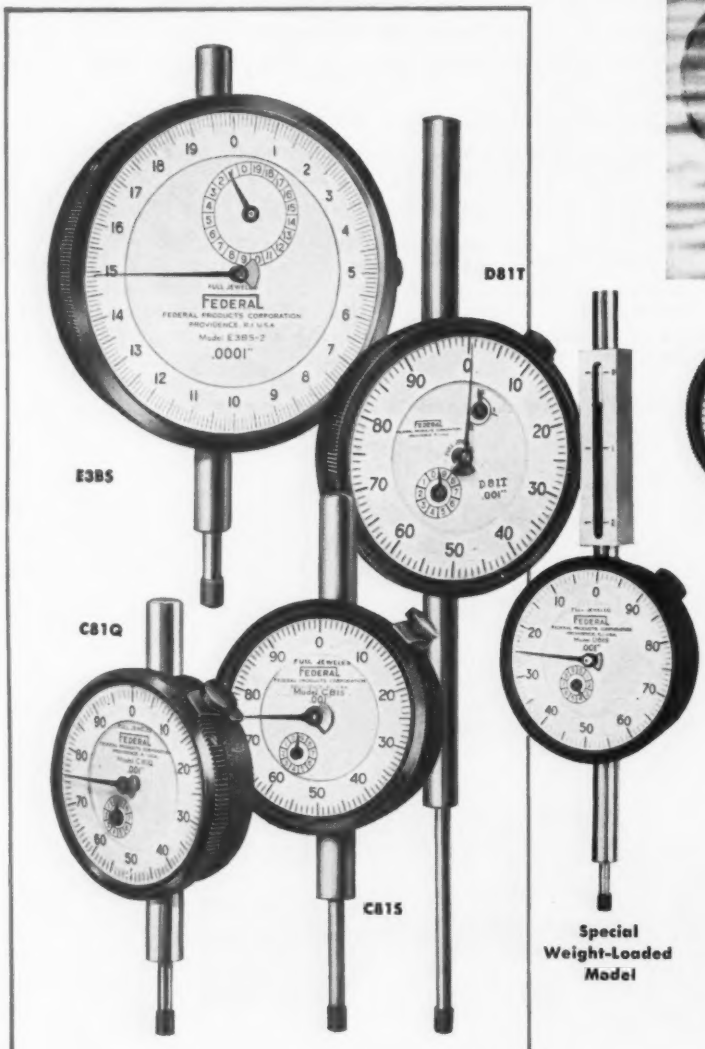
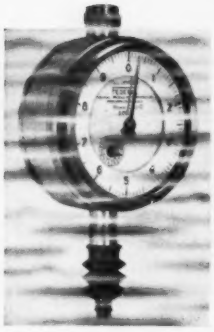
You get the benefits of doing business with a company which consistently offers improvements and new ideas.

You get a known accuracy and dependability built up over years of development and experience.

You save the confusion of stocking and maintaining several different makes of instruments.

LONG RANGE MODELS





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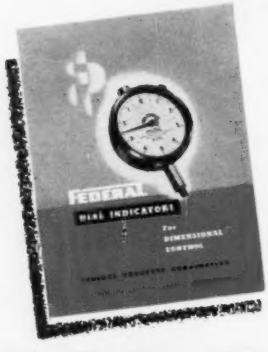

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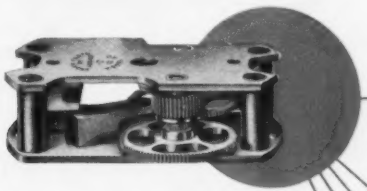

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Assures Perfect Alignment
Positive Adjustment — Rigidity —
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Maintenance men tell us repeatedly it is the easiest to repair.

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LOW FRICTION
ANY GRADUATION
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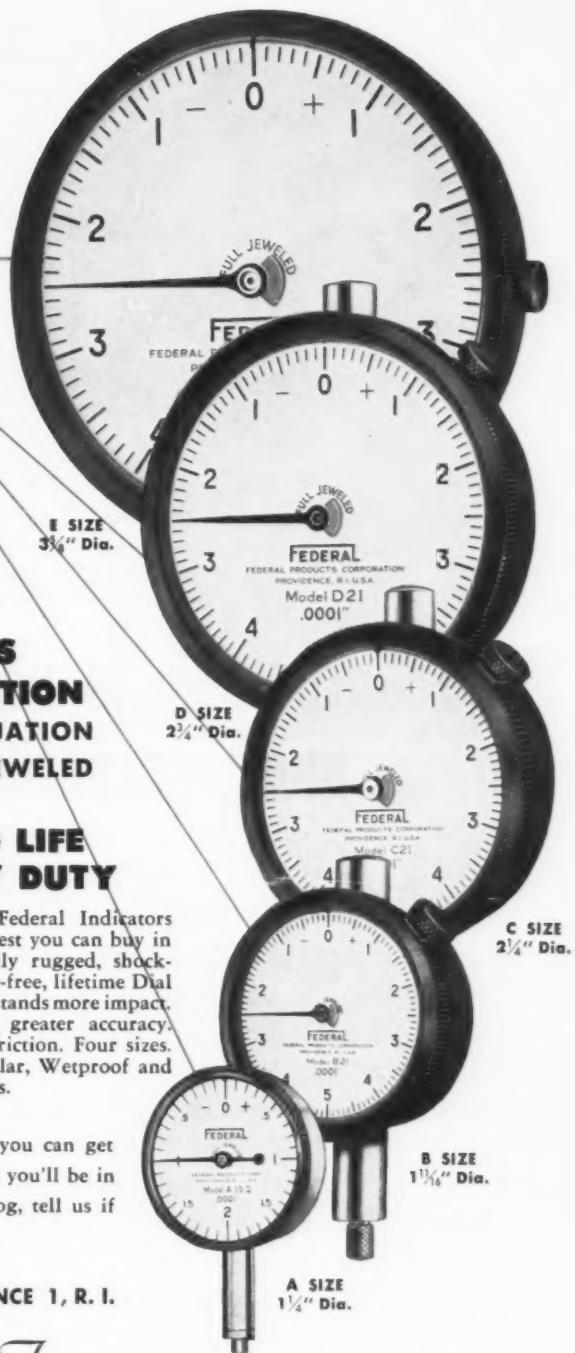
Another new in Federal Indicators (H Model). The best you can buy in every way. A really rugged, shockproof, maintenance-free, lifetime Dial Indicator that withstands more impact. Low maintenance, greater accuracy. 16% to 25% less friction. Four sizes. Furnished in Regular, Wetproof and Long Range models.



Whatever you need in Dial Indicators and Accessories you can get from Federal (direct from our Branch Offices too.) And, you'll be in line for new developments later. If you haven't a catalog, tell us if you want one.

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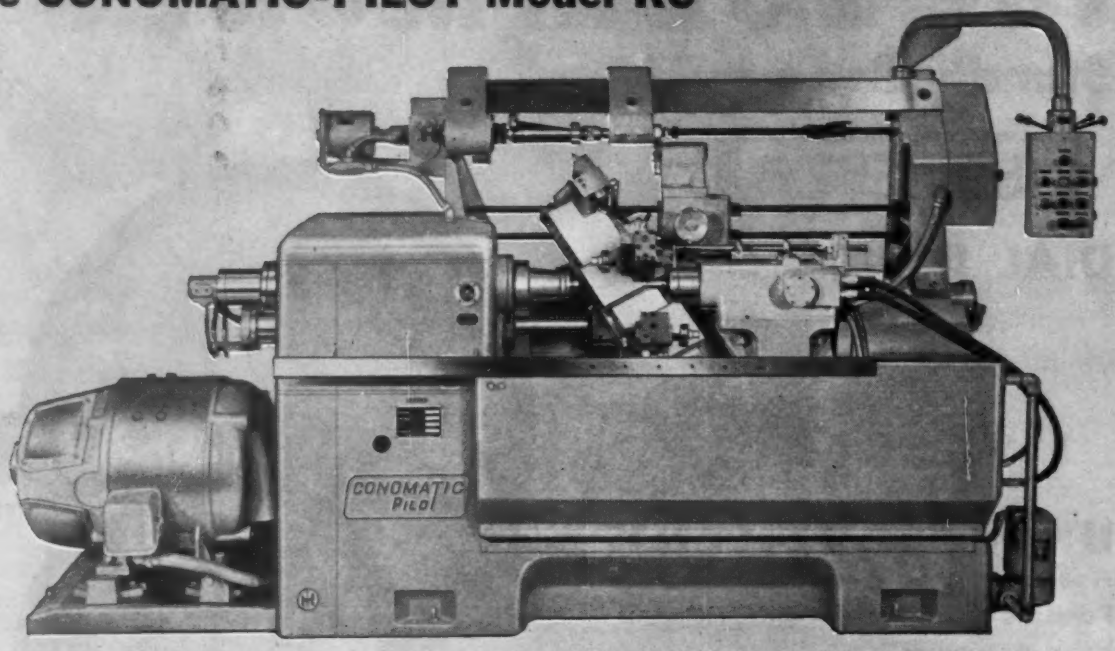
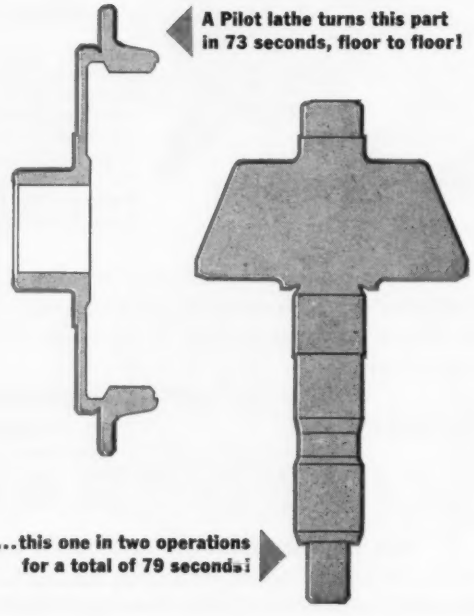
The CONOMATIC-PILOT Model KU



Cone Automatic is now manufacturing the world's most versatile copying lathe...

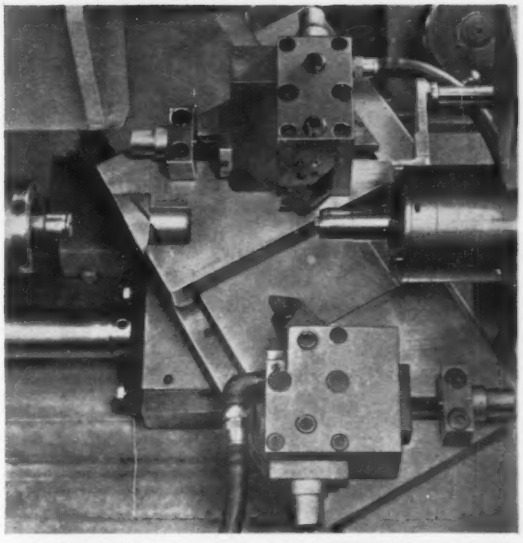
Cone Automatic Machine Company has acquired all rights to the manufacture and sale in the United States and Canada of the famous Pilot lathe. This hydraulically-controlled multicycling copying lathe has already proved its unique adaptability to automated production layouts in the plants of leading U. S. automobile producers and other manufacturers whose products require parts profile-turned to precise tolerances.

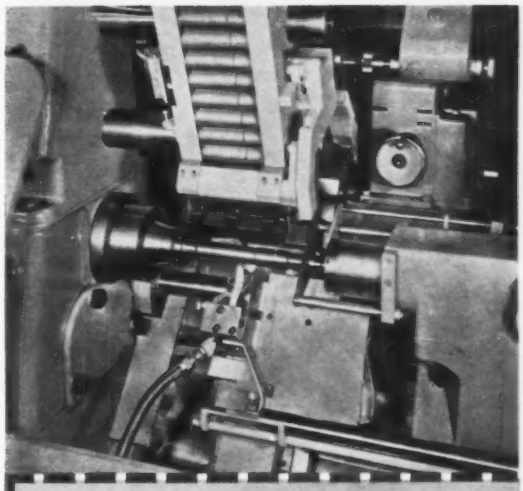
For more details, mail the coupon at the bottom of the right hand page today. We will send you a copy of the new Conomatic-Pilot Lathe Catalog. It's yours for the asking.



The Conomatic-Pilot KU offers:

- The advantage of a single-point copying lathe plus adaptability to virtually any number of tool stations. Top photo shows typical set-up.
- Smooth, even finish on all surfaces of the work piece: piloted hydraulic feed provides constant feed per revolution.
- Advantage of dual motion tool blocks when using 60° slide (see middle photo).
- Plenty of space near work area to mount automatic feeds and unloading systems. A typical automated arrangement is shown in the bottom photo.
- All cutting tools tangentially mounted for vibration-free operation.
- 45° inclined bed to ease chip removal—wear-proof nitrided steel slide ways.
- Rear tool blocks that can plunge-cut 90° shoulders or copy turn in reverse.
- Front and rear tool blocks that can copy different profiles from same motorized rotating template.





Conomatic

CONE AUTOMATIC MACHINE CO., INC., WINDSOR, VT.

PILOT DIVISION

30 Rockefeller Plaza, New York 20, N. Y.

PILOT DIVISION

Cone Automatic Machine Co., Inc.
30 Rockefeller Plaza New York 20, N. Y.

Please send me a copy of your new catalog on the CONOMATIC-PILOT hydraulic copying lathe.

NAME_____ TITLE_____

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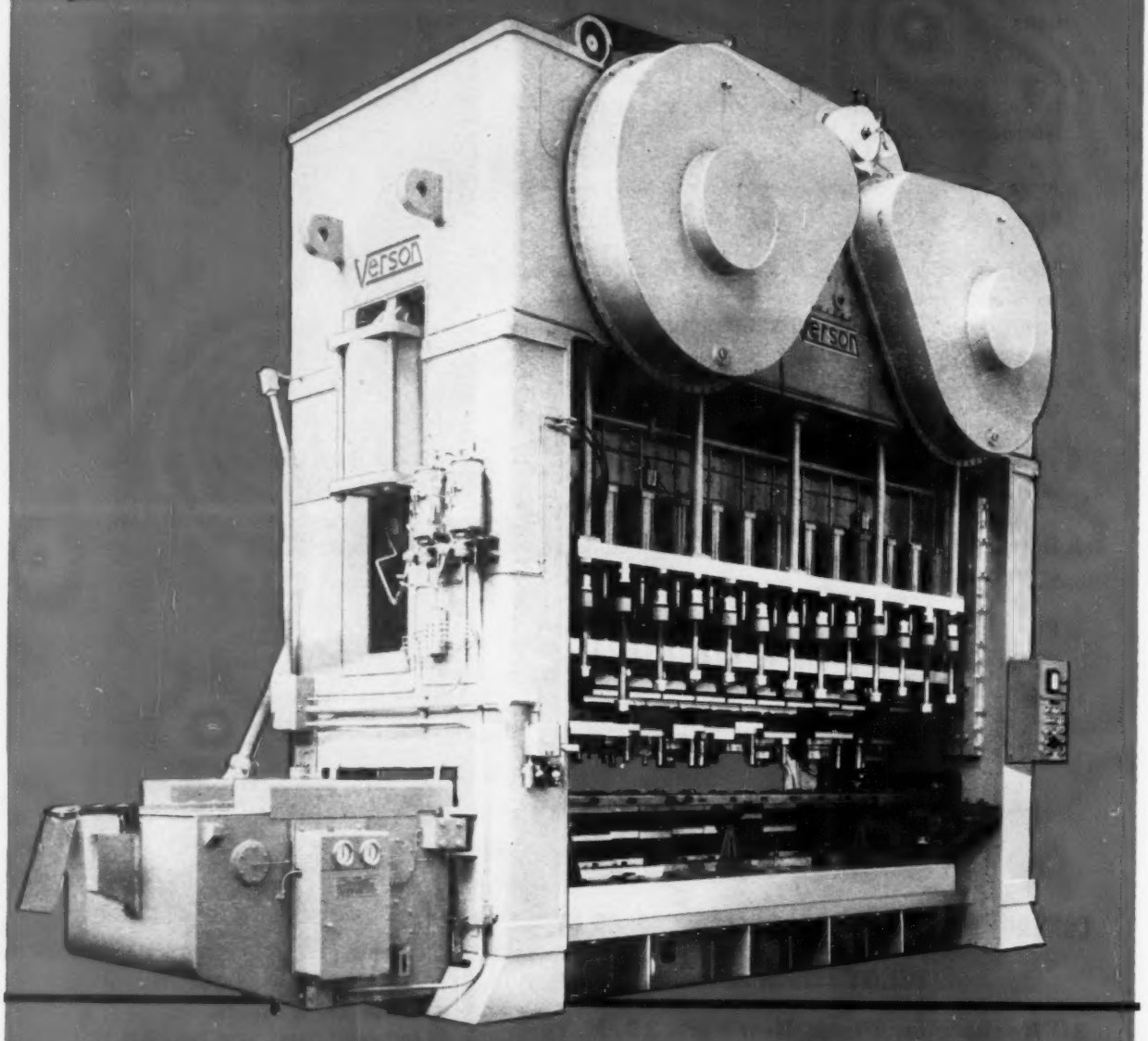
COMPANY_____

CITY_____ STATE_____

TRANSMAT

TRADE Verson MARK



A typical 600 ton Verson Transmat Press which performs a total of 15,000 press operations per hour on electric motor housings.

FORMING...

The Proven Precision Method for Mass Production Stamping

HERE'S THE PROOF...

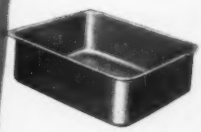
COIL CONTAINER

In ten years over 50,000,000 automotive ignition coil cases have been produced by the Verson Transmat Process at a rate of 1300 per hour. The case is blanked and drawn from .15" stock and is 2" in diameter, 5" deep.

WASHER LEG

One of the first intricately shaped parts formed by the Transmat process over nine years ago, this washer leg is 21 ¼" long, 4" wide in 16 gauge steel. It was formed from pre-blanked stock at the rate of 900 per hour.

RANGE DRAWER



Formed on what was described ten years ago as the "world's largest automatic deep drawing press", this drawer measures 15" x 18" x 6" deep. It is formed from .035" coil stock at the rate of 500 per hour.

AUTOMOTIVE SPRING SEAT

One of two types of seats produced on the same Transmat Press, the seat pictured measures 2" by 5¼" by 1⅝" deep. Two at a time are formed from ¼" stock at the rate of 2200 per hour. In production over a year.

• The production figures quoted above are not theoretical rates computed on the drawing board. They are verified production figures based on day-in, day-out experience over extended periods of time.

Only Verson, the pioneer of Transmat Forming can offer such proof of performance. Only Verson can offer the accumulated experience derived from the building of scores of Transmat Presses over a period of eighteen years.*

Out of this experience has come the knowledge that the first consideration in the design and construction of a Transmat Press must be the production of multi-operation stampings at the lowest possible cost. No other consideration can be allowed to interfere.

Therefore, if you must produce 4000 or more identical stampings daily which require four or more operations, Verson Transmat Presses offer you the best opportunities for slashing production costs. We welcome the opportunity to show you what Transmats can do for you. Write or phone.

**The first Transmat is still in service producing 1300 oil filter shells per hour.*

A Verson Press for every job from 60 tons up.

TRADE "Verson" MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

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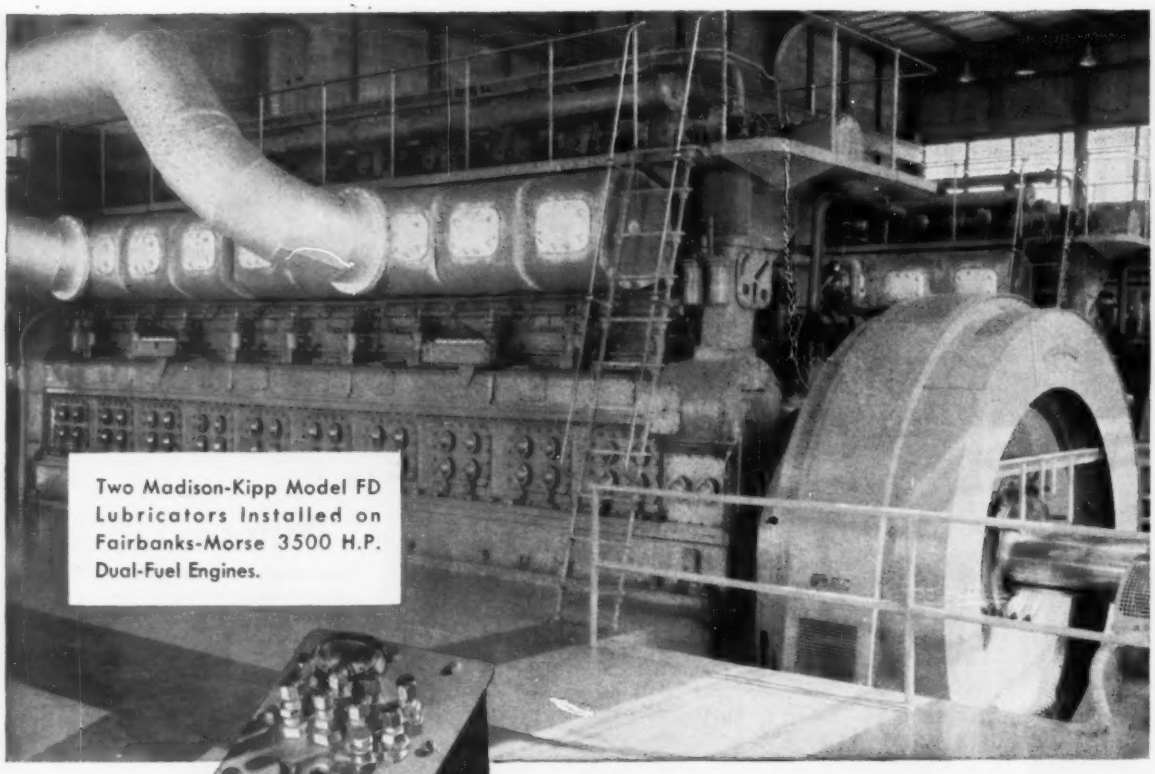

Two Madison-Kipp Model FD Lubricators Installed on Fairbanks-Morse 3500 H.P. Dual-Fuel Engines.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

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...by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

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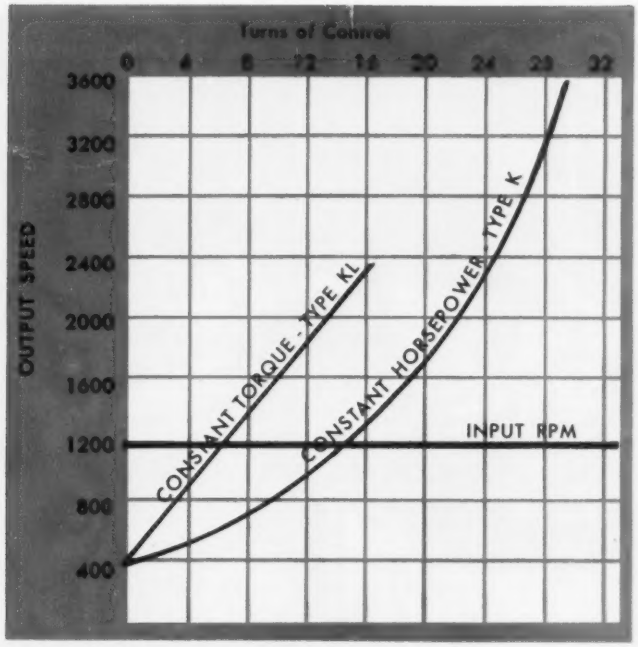
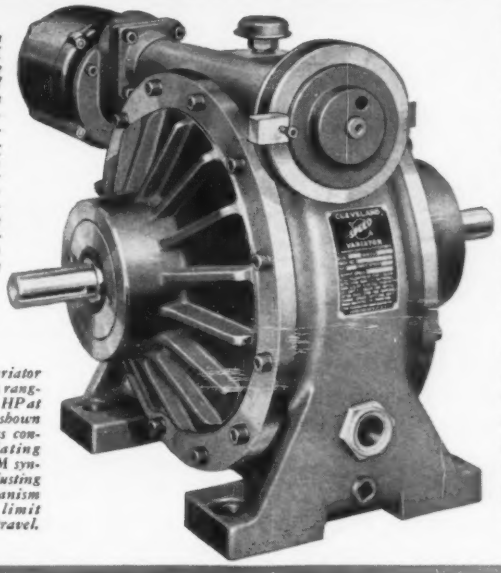
Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools



Typical speed regulation curves for the Types K and KL Variators. Type KL offers a linear speed regulating pattern, often an advantage in automatic control applications. Output speed regulation of the Type K Variator follows a geometric progression pattern. Starting at the minimum output speed, each turn of the speed regulating wheel produces a fixed percentage increase in output shaft speed.



The Cleveland Speed Variator is available in 18 models ranging from fractional to 16 HP at 1750 input RPM. Unit shown at right, used in process control, has speed regulating worm driven by 75 RPM synchronous motor, with adjusting shaft indicating mechanism modified to actuate limit switches to prevent overtravel.

CLEVELAND SPEED VARIATOR

Accurately Provides Dependable, Infinitely Variable Speed Control

ANNOUNCED late in 1954, the new Cleveland Speed Variator met instant, enthusiastic acceptance. Engineers and designers of industrial equipment already have put thousands of units into use on such varied equipment as cigarette making machines, textile machinery, metalworking machinery, pharmaceutical equipment, transfer tables, conveyors and experimental and testing equipment of many types.

Infinitely variable, the Cleveland Speed Variator gives stepless speed over a full 9:1 range—from ⅓ to 3 times input speed. Output speed can be adjusted by either a hand wheel on the Variator or by manual or automatic remote control.

The Cleveland Speed Variator offers these major advantages:

1. An extremely compact unit with input and output shafts in line and rotating in the same direction.

2. Almost any input speed up to 1800 RPM can be used—either clockwise or counterclockwise rotation.

3. Rated for constant horsepower output over a 9:1 or 6:1 range; or for constant output torque over a 6:1 range.

4. Speeds infinitely variable over entire range of adjustment.

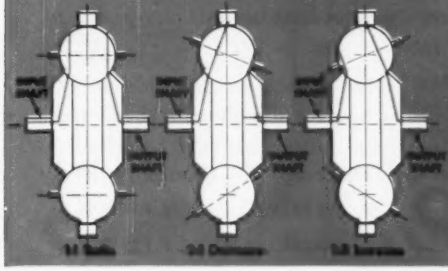
5. No slippage—positive torque response mechanism adjusts in direct proportion to the loads encountered.

6. Long life and minimum maintenance due to absence of belts or complicated linkages.

7. Ample bearing support for overhung pulleys on both input and output shafts.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.

HOW THE CLEVELAND SPEED VARIATOR WORKS



Power is transmitted from input shaft to output shaft through alloy steel driving balls which are in pressure contact with discs attached to the two shafts.

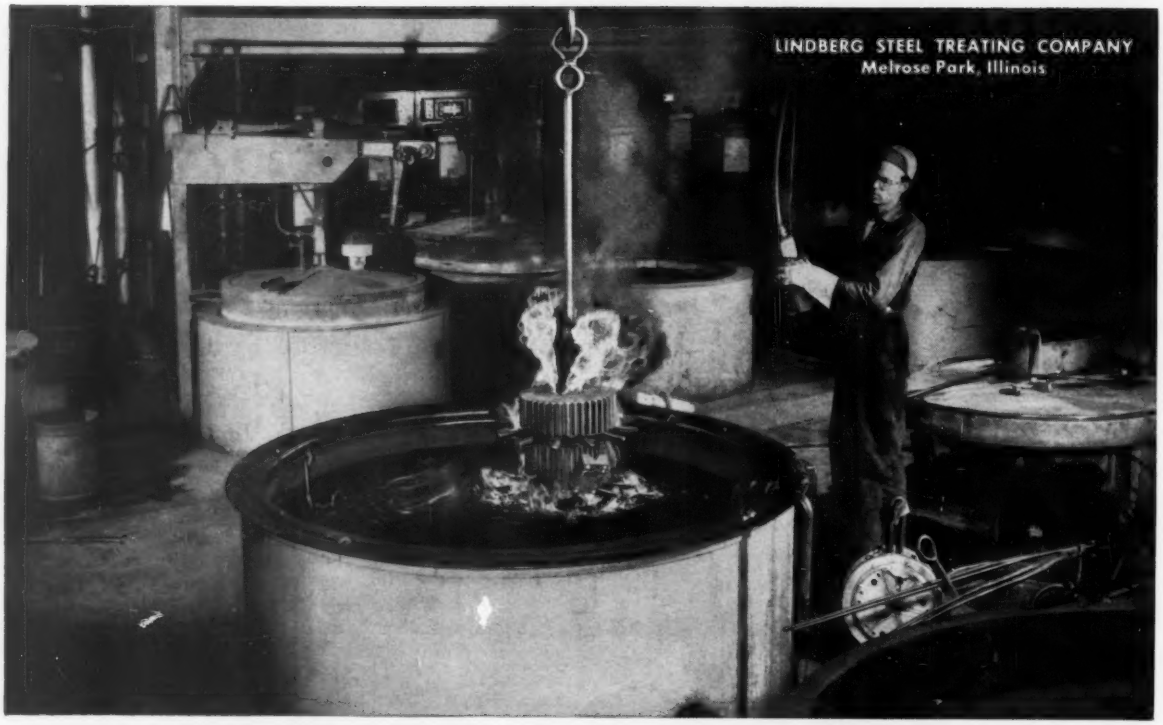
Relative speeds of the shafts are adjusted by changing the positioning of axles on which the balls rotate (diagram, right, shows cutaway Variator with hand regulating wheel).

"It's the Drive That's on the Ball."

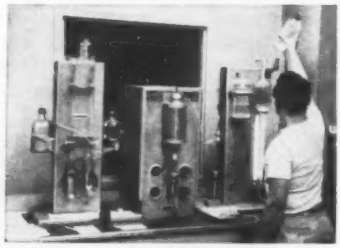
THE CLEVELAND WORM AND GEAR COMPANY

Speed Variator Division, 3276 East 80th Street, Cleveland 4, Ohio

Sales Representatives in all major industrial markets • In Canada: Peacock Brothers Limited.



For machine shop tolerances— Lindberg uses Cities Service Quenching Oil



Lindberg's Lab stringently tests treated metals. Dimensional changes from poor quenching oil would quickly show up here. But Cities Service Quenching Oil cools metal with no significant dimensional change.

Some of Lindberg's Furnaces. Here, they heat-treat all kinds of steel products . . . bolts, washers, gear blanks, saw blade segments, etc. Steel for bars of Illinois State Penitentiary was one of their first jobs.

At Lindberg Steel Treating Company a routine order might include a dozen shafts, stamping and forming dies, jigs and fixtures and even production parts. But though the products might differ, most would carry the same stipulation—heat treat with very low dimensional change.

To some heat treating operations this might present a problem, but not to Lindberg. By the use of Cities Service Quenching Oil, they're able to cool their steel with no significant changes in dimension.

"In addition," say Lindberg metallurgists, "we like Cities Service Quenching Oil because it has high flash point, consistent viscosity, excellent oxidation resistance. and a stable cooling rate."

Anyone looking for a better quenching oil would do well to try this superior Cities Service oil. For further information, talk with your local Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

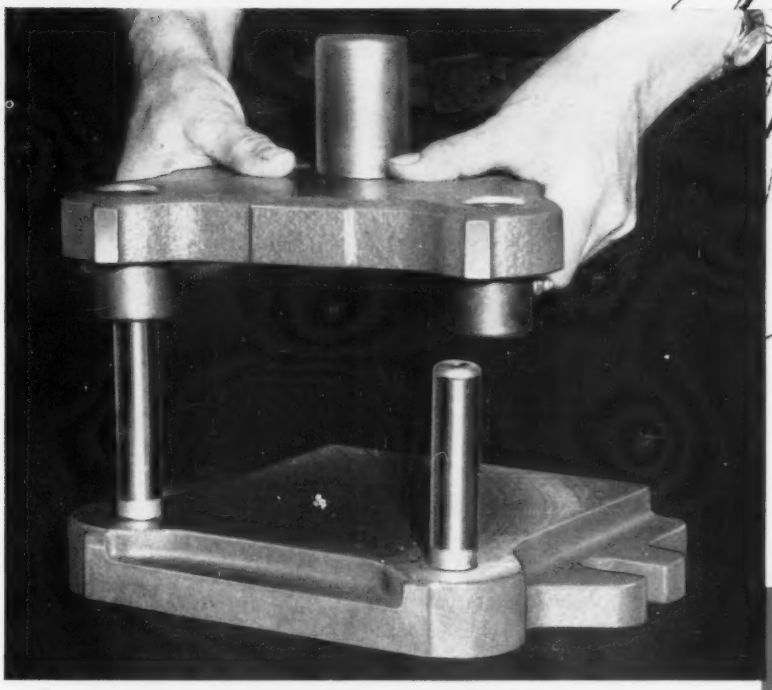
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

NEW

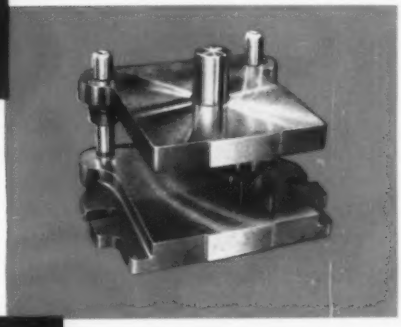
Easy Punch Holder Removal

ON NEW DANLY DIE SETS



Danly's leadership in die set design is seen in another improvement . . . easier removal of punch holders. On ordinary sets, punch holders often bind near the top of the guide posts as they are being removed. Standard Danly Die Sets are assembled with one post a half-inch shorter than the length specified . . . thus, the punch holder swings free before binding can occur. Isn't this another important reason why you should specify die sets from Danly?

complete new
"leadership line" catalog
More than 200 pages provide you with complete design information, easier selection of die sets and supplies.
Write for your copy today!



DANLY MACHINE SPECIALTIES, INC.

DANLY®

2100 South Laramie Avenue
Chicago 50, Illinois

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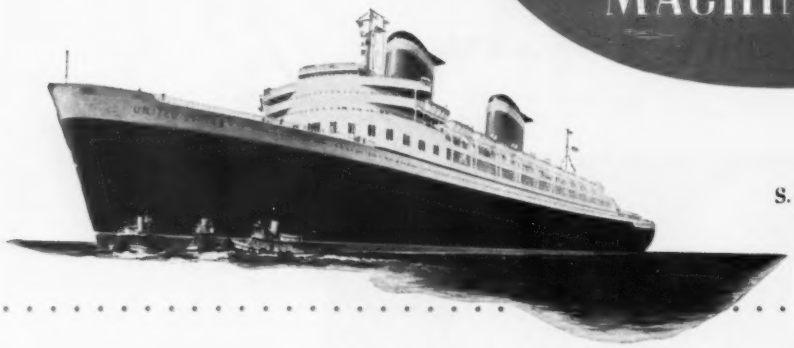
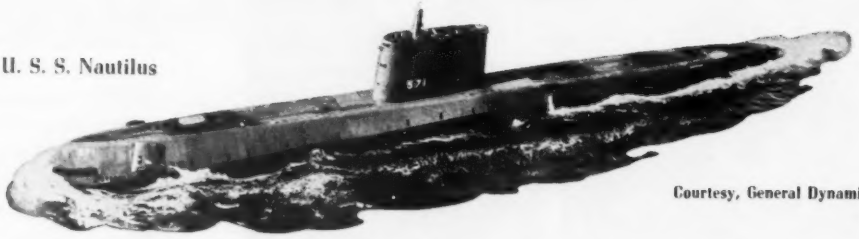
The PRECISION GEARS which Drive these Great Ships were Finished on

RED RING HORIZONTAL SHAVING MACHINES



S. S. United States

U. S. S. Nautilus



Courtesy, General Dynamics Corporation

U. S. S. Forrestal

Red Ring horizontal rotary shaving machines were used by Westinghouse Electric Corporation to finish the main propulsion gears of these great ships and many others.

Rotary Shaving assures precision in external and internal gears of all sizes. Write for information on your gear problems.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

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5600 ST. JEAN • DETROIT 13, MICHIGAN

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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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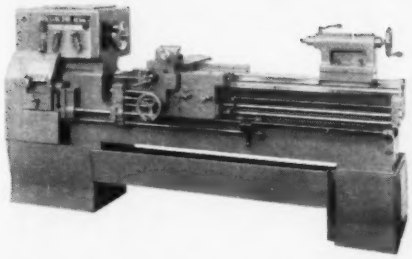
LeBlond Sliding Bed Gap Lathes

The most versatile lathes in the world

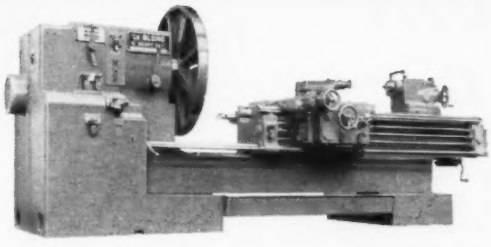
17"/28" *Regal*



For turning a variety of parts—particularly the unpredictable extremes you encounter in maintenance and job shop work, LeBlond Sliding Bed Gap Lathes are unsurpassed. At left is the 17"/28" Regal, smallest of the four LeBlond Sliding Bed Gap Lathes.

Major features, 17"/28" Regal: Hardened and ground replaceable steel bed ways. Combination gear-belt drive headstock. 12 spindle speeds, 48 feeds and threads. Both feed rod and leadscrew. 3 bearing spindle. *Write for Bulletin RG-210-A.*

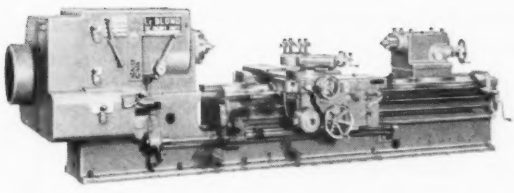
16"/38" *Heavy Duty*



With bed closed, LeBlond Sliding Bed Gap Lathes function as regular engine lathes. The special bed slides open to form a gap that will accept odd-shaped parts and large diameter work. This also provides greater bed length, more than 50% greater distance between centers.

Major features, 16"/38" Heavy Duty: Combination gear-belt drive provides a complete speed range from 16 to 2000 rpm. 4-way power rapid traverse. New spindle mounting for safe high speeds. Hardened and ground bed ways. *Write for Bulletin SBG-104-A.*

25"/50" and 32"/60" *Heavy Duties*



Seventy years of LeBlond experience in solving day-by-day turning problems, extensive laboratory research and practical ideas from our own shop combine to give Sliding Bed Gap Lathes features to meet your turning requirements for years to come.

Major features, 25"/50" and 32"/60" Heavy Duties: 36 speeds at high power. 4-way power rapid traverse. Automatic lubrication in the headstock, quick change box and apron. Hardened and ground bed ways. Anti-friction bearings throughout. *Write for Bulletin SBG-106-D.*

The R. K. LeBlond Machine Tool Company

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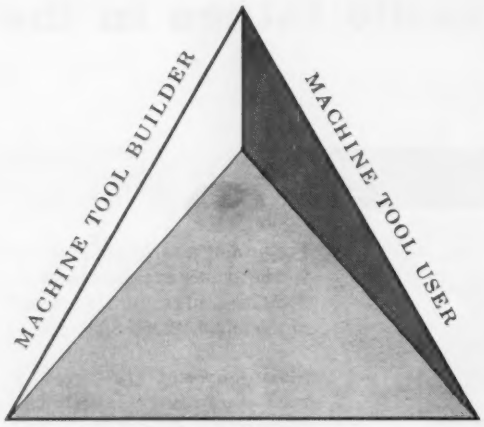

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The very essence of automatic metalworking and part transfer is CONTROL. And, for greatest effectiveness, control must be an integral part of the basic design of the system—not a belated afterthought.

Thus, the Automation Pyramid rises from a base that incorporates the concurrent efforts of the user, the machine tool builder and the "autometrologist"*. Each contributes essential knowledge and experience that is exclusively his.

The user alone can define the task by specifying the design, quality and production rate of the product to be made.

The machine tool builder defines the sequences in metal removal, the speeds and feeds. The "autometrologist" is responsible for the choice and combination of sensing, measuring, prediction, feedback, machine control and assembly operations.

Before embarking on your automated project, take advantage of Sheffield's extensive experience in "Autometrology". It will save much valuable time and reduce operating cost. Write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 9.

**AUTOMETROLOGY—The science of combining machining, motion or memory with automatic measuring.*

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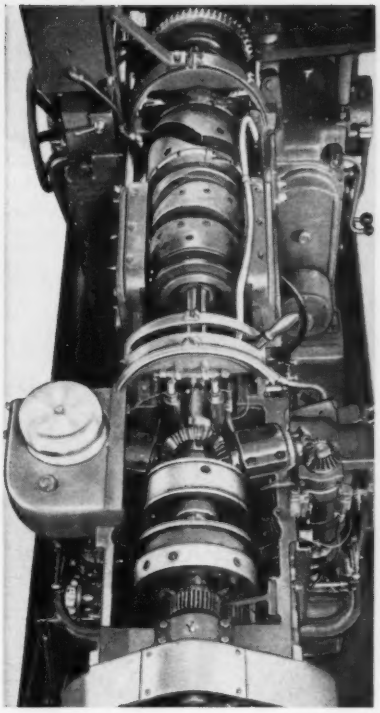
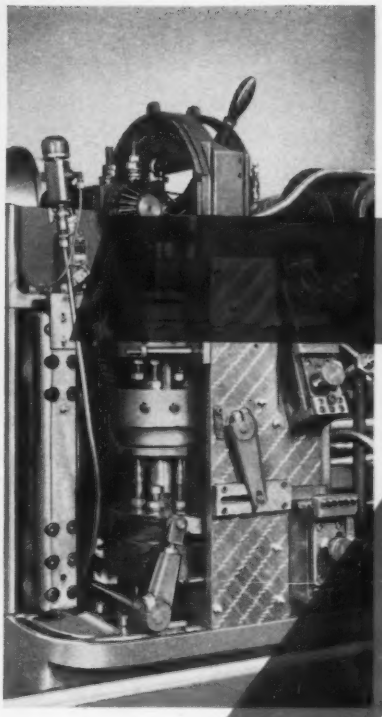
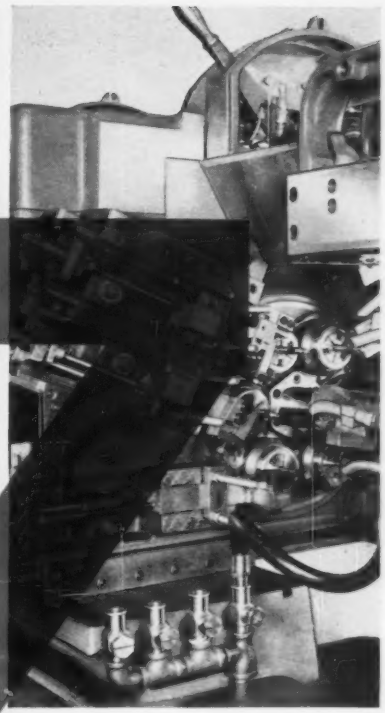




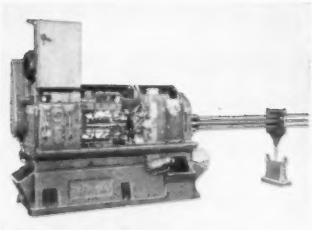


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

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Schiess KZ 250 Double Column Vertical Boring Mill machining a 6-station index turntable, 24" high, 96" diameter, used by automotive manufacturer for an automatic machine.

"Our Schiess vertical boring mill DOES THE JOB 3 TIMES FASTER, MORE ACCURATELY, with a BETTER FINISH!"

Hahn Manufacturing Company, 5332 Hamilton Ave., Cleveland

Jobs of increased size and time limitations no longer hold back production at Hahn Manufacturing Company.

The company reports: "Our Schiess machine has already handled a 60" high cast iron cylinder and a 108" diameter ship propeller. We cut production time by using the two boring heads together. For instance, one head can be used for roughing while the other is finishing. Or one head can be used for turning while the other is boring.

"Our operators claim the machine is just about foolproof. They like the cross-rail electro mechanical controls. They also praise the hydraulic pre-selection of speeds, the finger-tip control for direction of feed and rapid traverse, and the all-vertical gear drive. Another thing—no special training was needed. Our regular machinists put it right to work as soon as they learned the controls.

"The Schiess mill does our big jobs just about three times faster, provides a better finish, is more accurate and results in less spoilage."

Get to know this product of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be happy to help you size up this heavy producer for your heavy production needs.

Write for catalog and complete specifications.

Standard Model KZ Double Column Vertical boring mills are available with 80", 98" and 118" turning diameters.

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BEFORE THEY COME TO FAIR STREET

They tell us we are exaggerating . . .

"The JIGMIL Technique, through a high degree of accuracy, speed and push-button control, introduces an entirely new philosophy of duplicate production—a method involving substantial savings."

If we sat down across the desk from you and explained what we had done with the JIGMIL Technique in boring and milling parts similar to your own, the chances are you wouldn't believe us. Few people do. But we don't blame them. The JIGMIL Technique sounds too visionary. Savings seem too great. *Although simple, the* JIGMIL *Technique is so revolutionary that you have to see it to believe it.* Will you come to Fair Street (home of the JIGMIL) and see for yourself? We would be delighted to have you.

C. B. DE VLIEG

DE VLIEG MACHINE COMPANY 450 FAIR STREET

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Foote-Burt Company
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Hamilton Tool Co.
Heald Machine Co.
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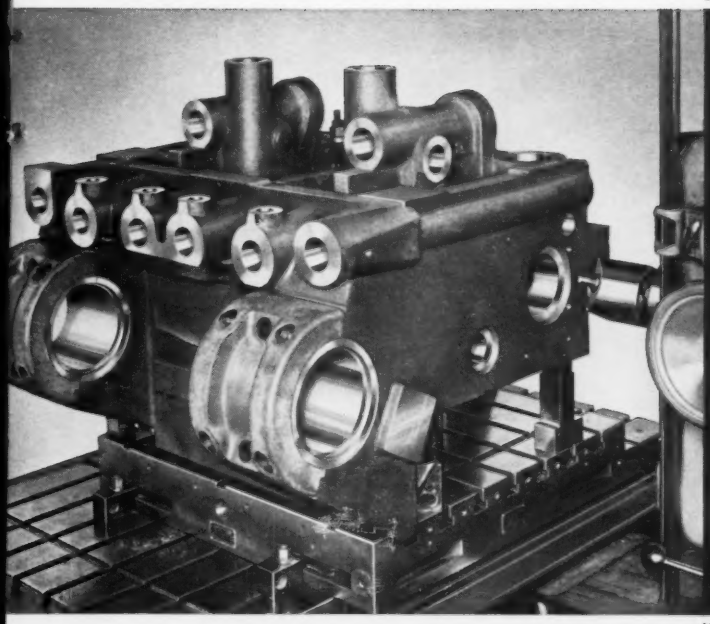

A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error . . . even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

ACCURACY IS AN ECONOMY!

A TYPICAL EXAMPLE OF JIGMIL ECONOMY

At one setting! On four sides! Without the aid of jigs! This horizontal broaching fixture was completely machined—*bored* and *milled* to precise limits of accuracy. The JIGMIL Technique requires a minimum of tooling and technical skill to produce precision parts.

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Sheffield Corporation
Snyder Tool and Engineering Co.
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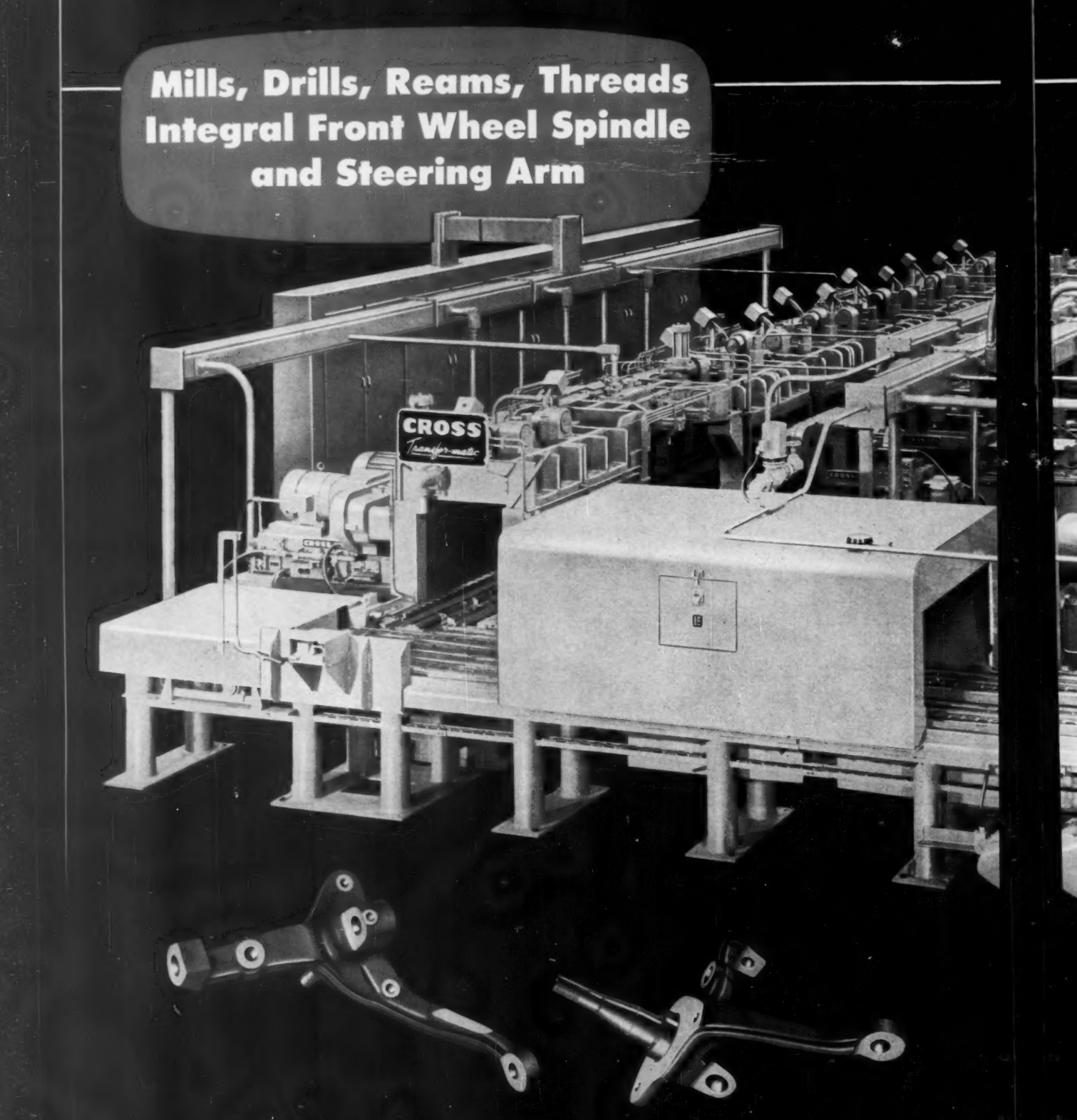
SPIRAMATIC JIGMILS®

Mills, Drills, Reams, Threads Integral Front Wheel Spindle and Steering Arm



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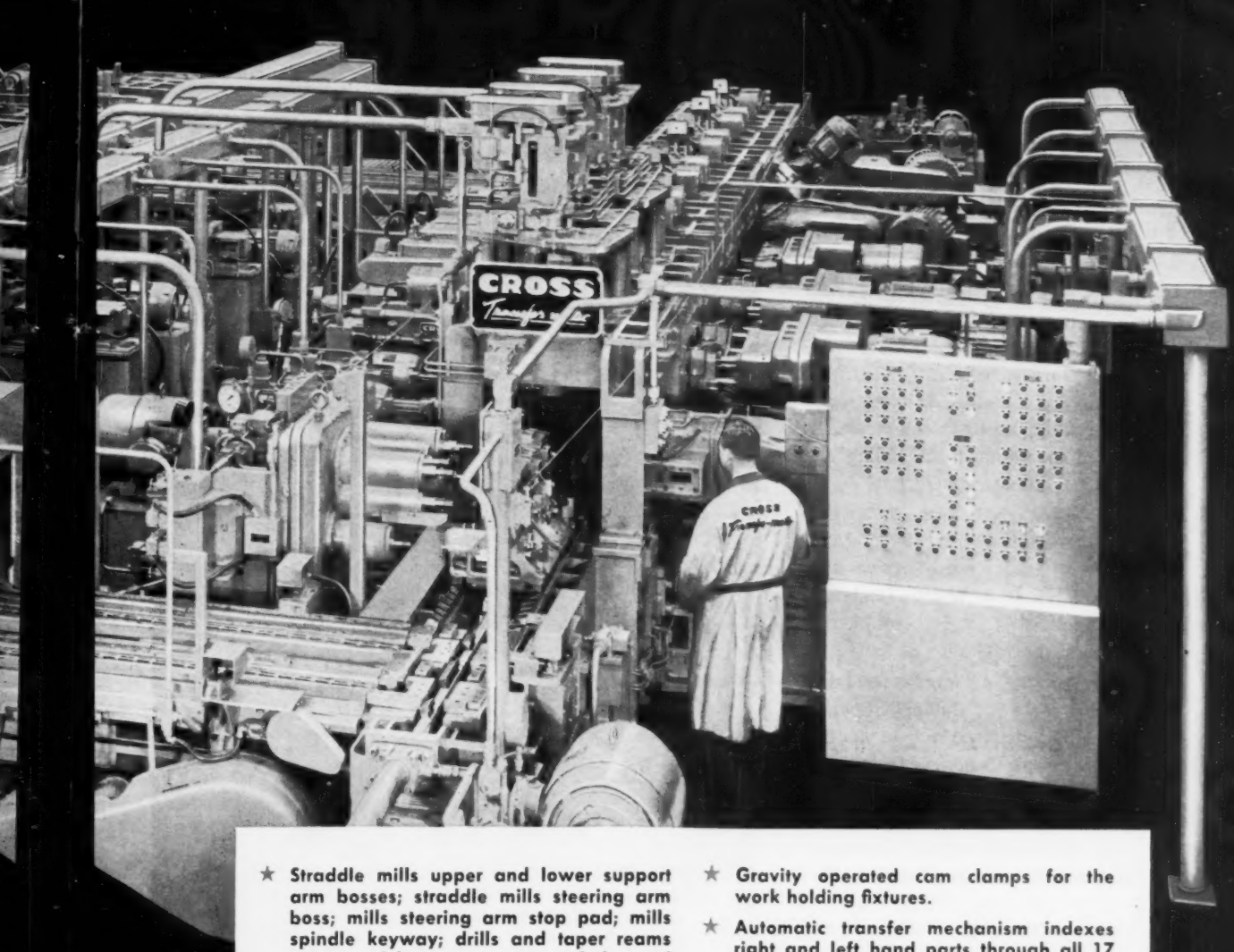
THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Formerly only 15,000:

Another Transfer-matic by Cross

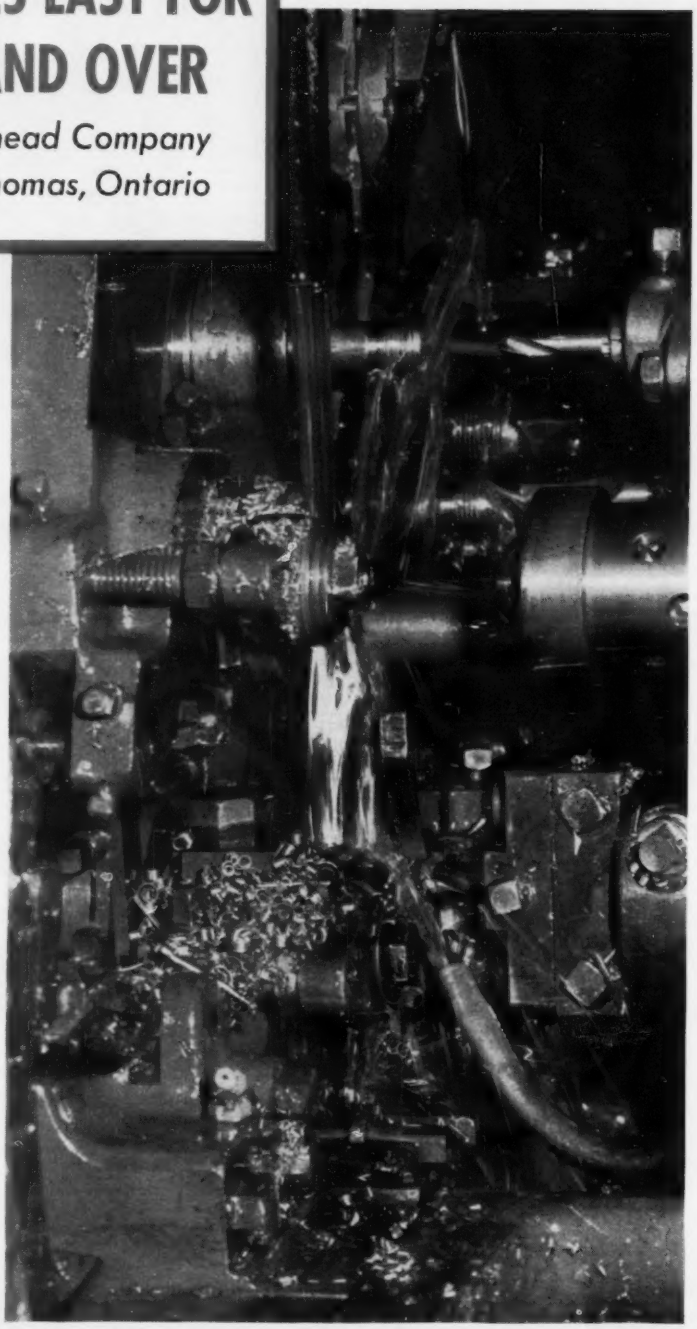


- ★ Straddle mills upper and lower support arm bosses; straddle mills steering arm boss; mills steering arm stop pad; mills spindle keyway; drills and taper reams upper and lower support arm holes and steering arm hole; drills, reams, chamfers and spotfaces two brake mounting plate holes; drills, counterbores, spotfaces, chamfers and reams brake anchor hole; drills spindle cotter pin hole; and threads wheel spindle.
- ★ 144 right and 144 left hand parts per hour at 100% efficiency.
- ★ Pallet type work holding fixtures locate parts from spindle bearing diameters.
- ★ Power wrench clamps work holding fixtures automatically.
- ★ Gravity operated cam clamps for the work holding fixtures.
- ★ Automatic transfer mechanism indexes right and left hand parts through all 17 stations in pairs.
- ★ Automatic indexing units turn fixtures 82° at Stations 11 and 17.
- ★ Cross modular unit construction provides flexibility for design changes.
- ★ Other features: construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and reaming; individual lead screw feed for threading; automatic fixture cleaning unit; complete interchangeability of all standard and special parts for easy maintenance.

Formerly only 15,000:

NOW THREAD ROLLS LAST FOR 100,000 PIECES AND OVER

. . . reports Weatherhead Company of Canada, St. Thomas, Ontario



The job is making ⅛" pipe plugs of B 1113 steel. Work is done on Davenport automatics, and the threads are rolled on.

Using a competitive brand of cutting oil, Weatherhead had been getting only about 15,000 pieces between roll changes and found excessive wear on form tools and drills. Seeking improvement, Weatherhead tested other brands of cutting oil including *Texaco Cleartex Oil B*.

Results with *Texaco Cleartex Oil B* were so vastly superior that it was quickly adopted for production runs. That was five years ago. Since then, Weatherhead has been getting a roll life of 100,000 pieces, and greatly increased life for all tools.

Texaco Cleartex Oil B is only one of the complete line of Texaco Cutting, Grinding and Soluble Oils designed to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the proper ones.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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- **Record Budget**
- **Topical Domestic Issues**
- **Washington Briefs**

Keeping up with Washington

By Loring F. Overman

IN his inaugural message to the world, and in his budget message to Congress, President Eisenhower made it clear that costly years are ahead. The budget message for fiscal 1958, calling for a total of $71,800,000,000, set a record for peacetime expenditure. Objectives for the President's second term in office include:

1. Peace, justice, and freedom for both our own and other peoples.
2. Powerful, armed forces to deter and, if need be, to defeat aggression.
3. A healthy and growing economy with prosperity widely shared.
4. Intelligent conservation, development, and use of our great natural resources.
5. Fiscal integrity.
6. Increasing international trade and investment essential to the economic growth of the United States and the rest of the free world.

Since the defense program affects the machinery world to a great extent, the military budget outlook is significant. Approximately 63 per cent of the 1958 budget will be earmarked for strengthening the defenses and economies of our own and other nations "in the interest of collective security and world peace."

Machinery people must look closely to research and development for the path to be taken by defense production. Said the President, "We are now engaged in the development of a whole new family of even more advanced weapons for all the services. Large expenditures will be required to bring these weapons into use. During the transition, we must continue to purchase enough of the current types to preserve our readiness until the effectiveness of the advanced weapons is demonstrable."

Topical Domestic Issues

Wage studies propose increased minimums as high as $1.50 per hour, plus increased coverage of retail and service establishments, and outside salesmen.

Right-to-work laws, enacted in eighteen states to forbid compulsory unionism, are being attacked on a national level. Opponents would make them illegal by federal statute. It seems they believe it would be easier to "sell" a majority of congressmen than to battle right-to-work sentiment state by state.

Secondary boycotts, forbidden by Taft-Hartley legislation but practiced through loopholes in the Act, are up for consideration. Labor is for repeal of the prohibition; management seeks to close the leak in the dike.

Taxes stand little chance of being reduced. New budget shows possibility of only small surplus—even at present rates. Expect extension of present excise rates and 52 per cent corporate income tax—minor changes, if any, in small business grouping.

Housing pressures may also prove troublesome to Congress. Everyone likes to see a nation well-housed. Unpopular are those who warn that easy housing may lead to not-so-easy inflation.

Aid to schools presents a similar problem. All favor better schools but many object to the possibility that federal subsidy fathers government control.

Power development by government or private industry? Congress will be asked to answer this question.

Atomic energy is closely linked to the private-or-public-power problem. There is the question as to who will build atomic power plants. Machinery people have much at stake. Industry is accused of holding back on research and development. Congress will decide.

Hoover Commission says savings of $5,500,000,000 a year in government expenditures are possible. Proposals continue to receive courteous consideration, little action. Proponents observe that congressional inaction merely reflects public apathy.

Washington Briefs

- Better business in 1957 than in 1956 is forecast by Secretary of Commerce Sinclair Weeks. His prediction is based on a survey of twenty-five industry divisions of the Department of Commerce.
- Aluminum shipments will reach record levels in the first half of 1957, Department of Commerce reports. Supply during the first six months is considered adequate; added capacity is in prospect for later periods. Aluminum companies are already considering possible new markets in housing and construction fields.
- Despite the diversion to industry of all nickel earmarked for government accounts during the first quarter of 1957, demand during the first six months is expected to exceed supply by 40 per cent.
- Steel production during the first half of 1957 is expected to set new records.
- Supply of refined copper for the first half of 1957 is expected to be adequate for industry, government, and export, provided no prolonged work stoppages interrupt production.

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ELMIRA, N.Y.

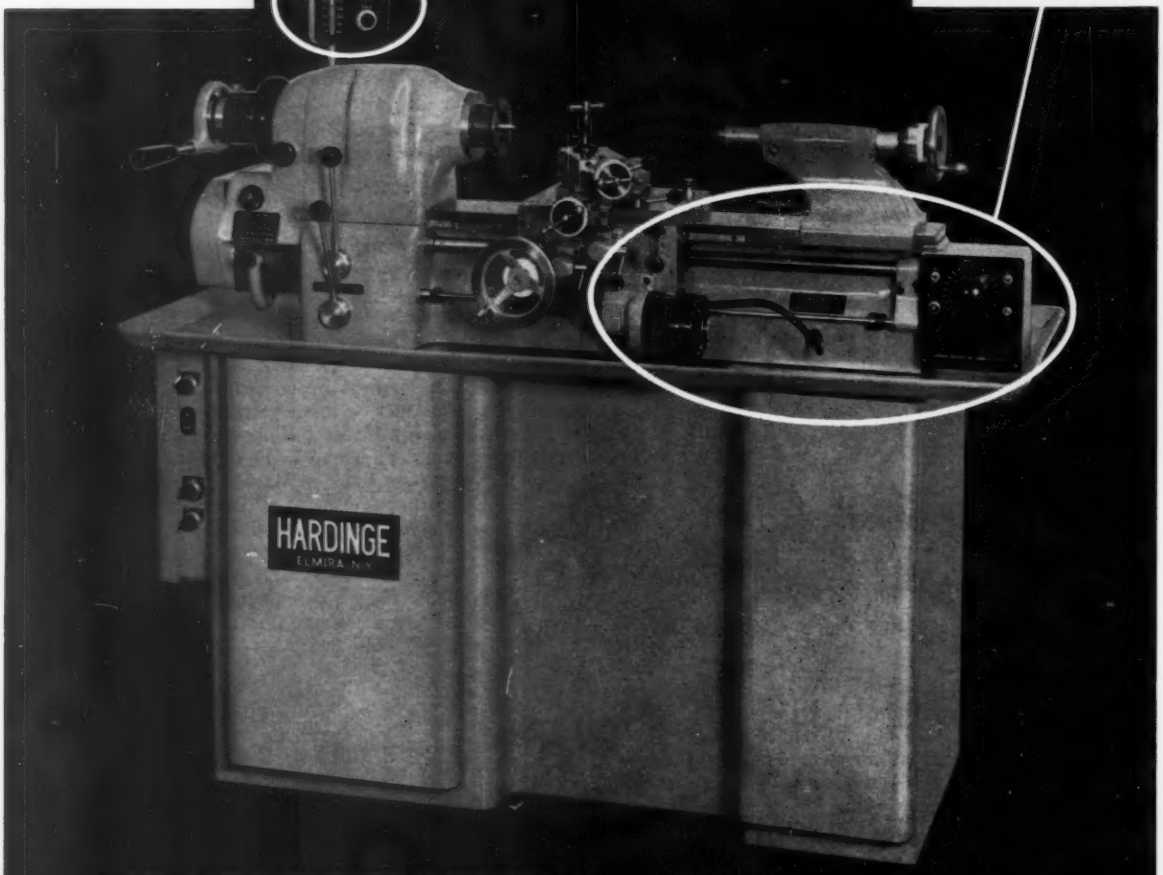
Tool Room and Production Lathe

Features

Infinite Control of Speed and Feed

Variable Speed Drive for Headstock Spindle

Variable Feed Drive for Carriage and Cross Slide



RIGIDLY BUILT TO TAKE ADVANTAGE OF CARBIDE CUTTING TOOLS AT HIGH SPEEDS.

Both drives are independent and infinitely variable to secure every possible combination of speeds and feeds.

Write HARDINGE *for Bulletin HLV*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York, N. Y.

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Machinery
MARCH 1957

Salesmen Welcomed!

ANYONE who has sat patiently, or otherwise, in a reception office for an hour or so awaiting the convenience or whim of the man he wanted to see knows fully the frustrating emotions that can come from such an experience. It is all too common an occurrence in the lives of salesmen and other traveling representatives.

It is a heartening experience, therefore, for a salesman visiting the American Welding & Mfg. Co. at either the Warren or Niles, Ohio, plant to be handed a welcome booklet with his name personalized in ink. This booklet contends that salesmen are "people" and, as such, merit every personal consideration from those they call upon.

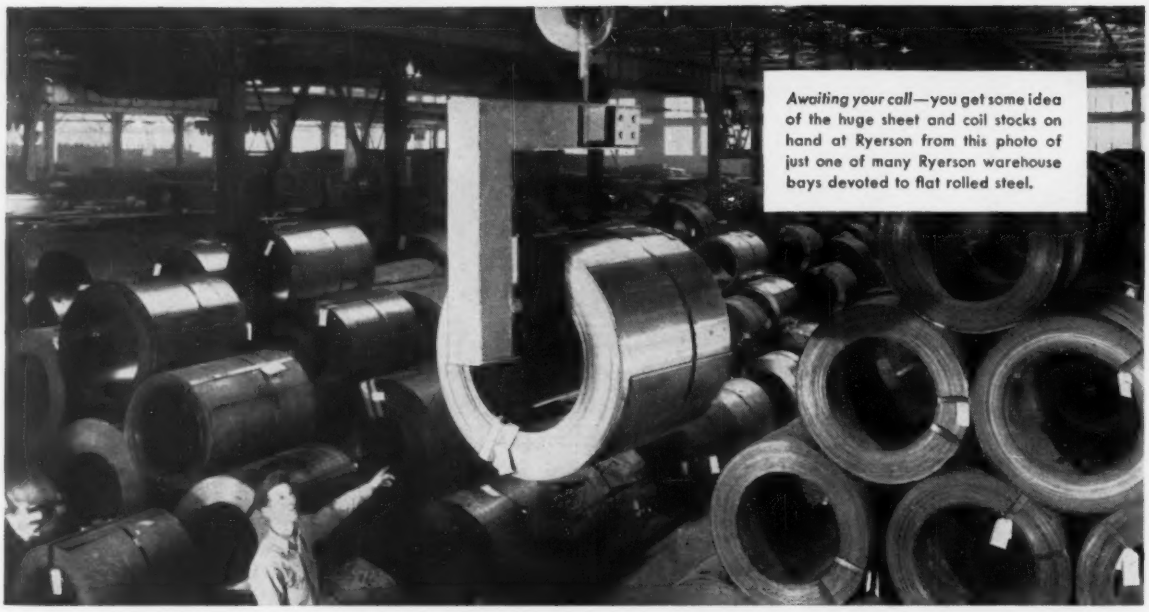
"We appreciate your coming to see us," states a message from the company president, "and as our guest, we want you to have every courtesy and attention while you are here. The information you bring to us may be of the greatest value in helping us to produce better, faster, or at lower cost. The intelligent efforts of salesmen and servicemen have benefited our business and every business. Any suggestions for the improvement of the reception afforded you, therefore, will be most gratefully received; and I should be glad to have you send your comments to me personally."

Welcome booklets or signs are not new in themselves, although they are not seen as frequently as the traveling fraternity might wish. But, surely, it is a novel experience to receive an expression of the value of salesmen to the firm with which they hope to do business.

The average salesman of machine tools and accessories and of other metal-fabricating equipment is educated technically to give expert advice on shop problems. Solicitation of his help can sometimes pay big dividends. To have this fact acknowledged in a courteous manner by a potential customer, even though a business deal is not consummated for some time, is sure to leave a lasting favorable impression on the caller.

Charles O. Herb

EDITOR



Awaiting your call—you get some idea of the huge sheet and coil stocks on hand at Ryerson from this photo of just one of many Ryerson warehouse bays devoted to flat rolled steel.

On sheet and strip requirements...

are YOU getting this 3-point service?

Sheet and strip buyers tell us that three kinds of purchasing help keep them coming back to Ryerson:

1. WIDER SELECTION OF TYPES—More than 20 kinds of sheet and coil stock are on hand in an unusually wide range of gauges—making it easier to get the exact steel needed for any requirement.

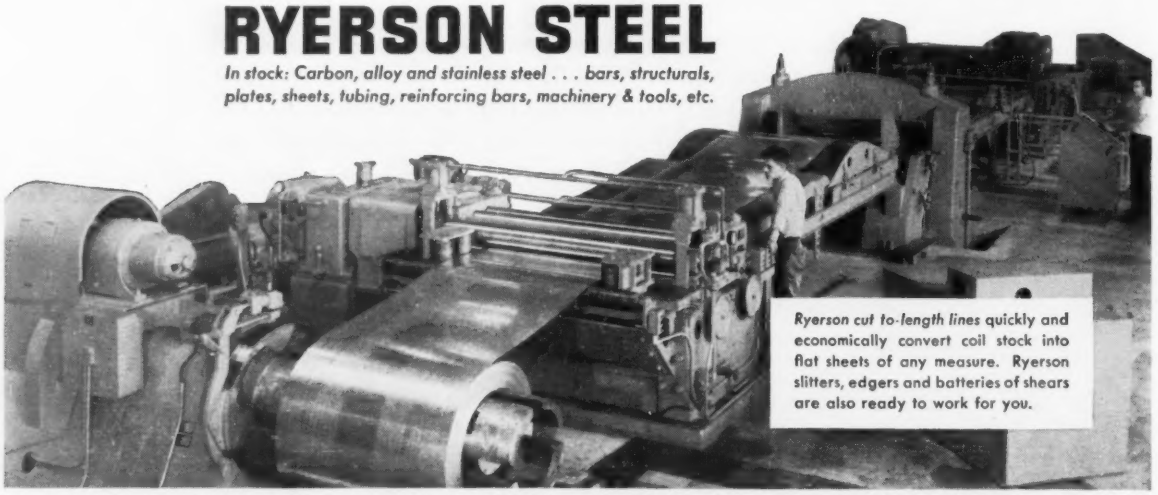
2. GREATER PROCESSING CAPACITY—The most extensive cutting and processing facilities in the steel-service industry enable buyers to get quickest service on requirements for special sizes, strip and sketch cutting, blanks, slit coils, edging, or any other processing.

3. HELP ON SHEET AND STRIP PROBLEMS—The large Ryerson staff of sheet and strip specialists gives buyers a valuable source of help in selecting the most satisfactory and economical stock—or in solving any other problem of application and fabrication.

In addition, sheet and strip buyers like the good packaging, the dependable weight and on-schedule delivery that they get from Ryerson—and the convenience of one-order buying of all steel products from the same source. So call your nearby Ryerson plant for 3-way help on sheet and strip needs.

RYERSON STEEL

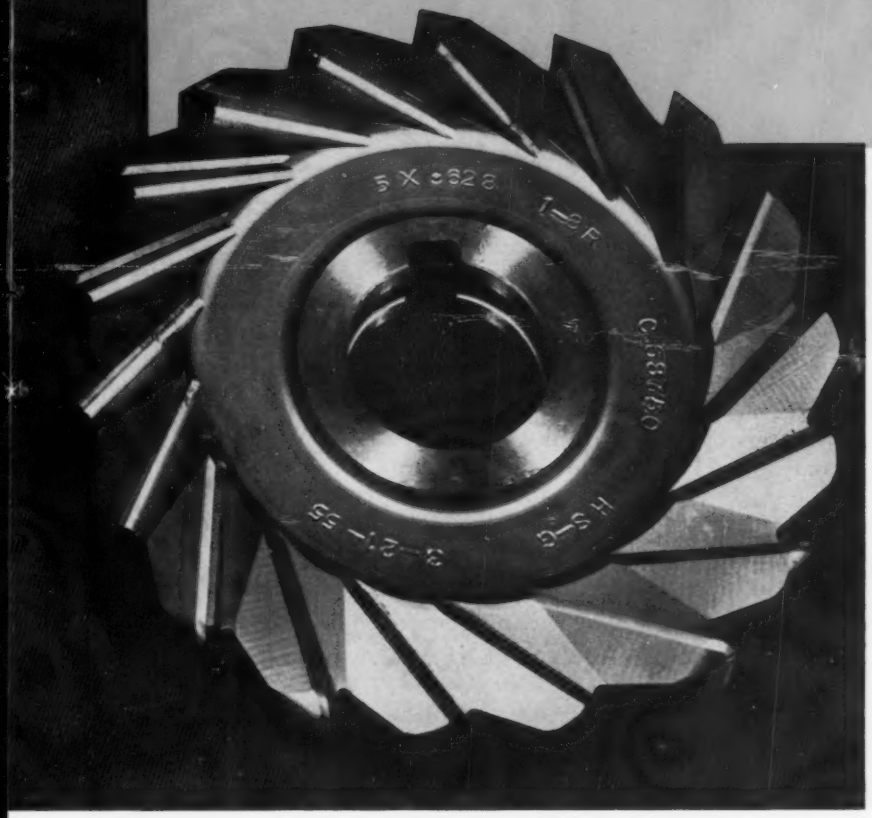
In stock: Carbon, alloy and stainless steel . . . bars, structurals, plates, sheets, tubing, reinforcing bars, machinery & tools, etc.



Ryerson cut to-length lines quickly and economically convert coil stock into flat sheets of any measure. Ryerson slitters, edgers and batteries of shears are also ready to work for you.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI CLEVELAND • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

A NEW LOOK IN MILLING CUTTERS



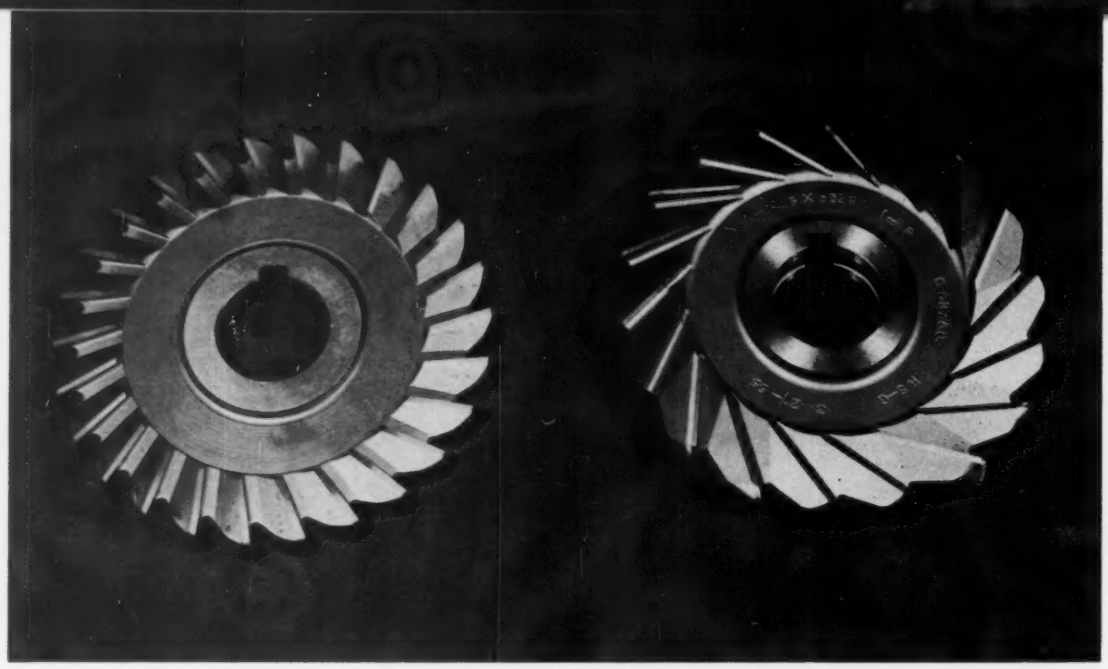
Generally accepted milling cutter designs are undergoing a face lifting. The change is in the concept of tooth shape. Rake angles have been increased to the point where the cutter teeth appear more suited to woodworking than to metalworking. However, noticeable increases in cutting speeds have been realized with this design.

By JOSEPH R. VARNAK, Industrial Engineer
Chicago Pneumatic Tool Co., Utica, N. Y.

SUBSTANTIAL increases in cutting speeds and feeds have been obtained by using milling cutters designed with exceptionally high rake angles. At the present time, approximately 125 milling jobs, covering a wide range of materials and types of operations, are tooled with these high-speed steel cutters at the Chicago Pneumatic Tool Co., Utica, N. Y. Average saving in over-all time has proved to be slightly under 50 per cent. All of this has been achieved with no change in either fixtures or handling procedures —only the speeds and feeds have been altered.

An obvious comparison between a 5-inch diameter slotting cutter of conventional design and the same diameter cutter having a high rake angle can be seen in Fig. 1. The standard cutter shown at the left has a rake angle of 4 degrees, while the high-rake cutter at the right has a rake angle of 32 degrees.

Chicago Pneumatic was introduced to high-rake milling cutters by Dr. William R. Frazer of the Union Twist Drill Co., Athol, Mass., at a meeting of the American Society of Tool Engineers. Answers to inquiries concerning these tools indicated that there were enough advantages to be gained through their use to warrant further investigation. Several general-purpose high-rake cutters were obtained and tried out. The objective was to find the limitations of the cutters and to determine whether presently installed equip-



ment was suitable as it was; whether it could be adapted if it was not suitable; and whether cost of adapting the equipment, if necessary, would be prohibitive.

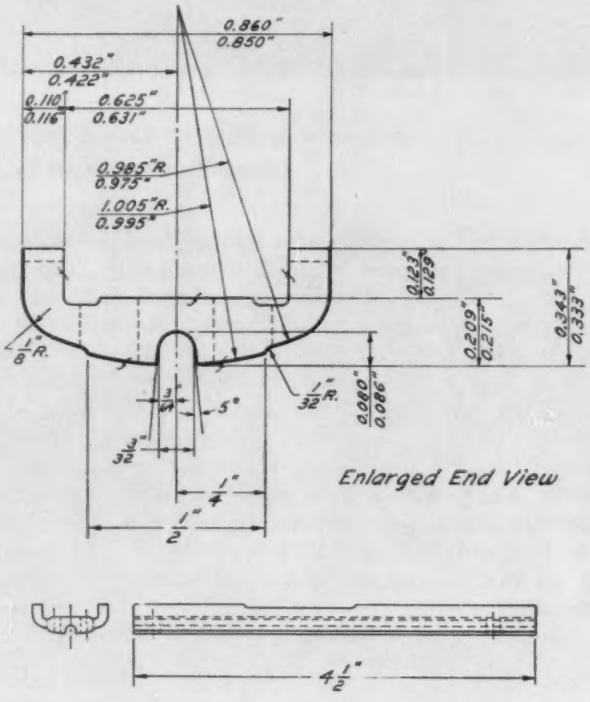
Conclusions Drawn from Test Results

As a result of the testing program pursued on the high-rake cutters, certain definite conclusions were drawn. It was found that cutting speeds and feeds could be greatly increased, if several precautions were observed. Among these are:

1. The cutter must run concentrically within 0.005-inch total indicator reading.
2. An abundant amount of coolant must be provided in the cut at all times.
3. The cutter must not be allowed to become excessively dull.
4. There must not be a great amount of spindle end play or table looseness.

Fig. 1. *(Above) A standard slotting cutter is shown alongside a high-rake slotting cutter. The conventional cutter, at left, has a 4-degree rake angle and the high-rake cutter, at right, has a rake angle of 32 degrees.*

Fig. 2. *(Right) Lower bearing track for a rivet pull-gun. The outer profile that is shown in heavy lines is machined in one pass employing a form-milling cutter designed with a high rake angle of 20 degrees.*



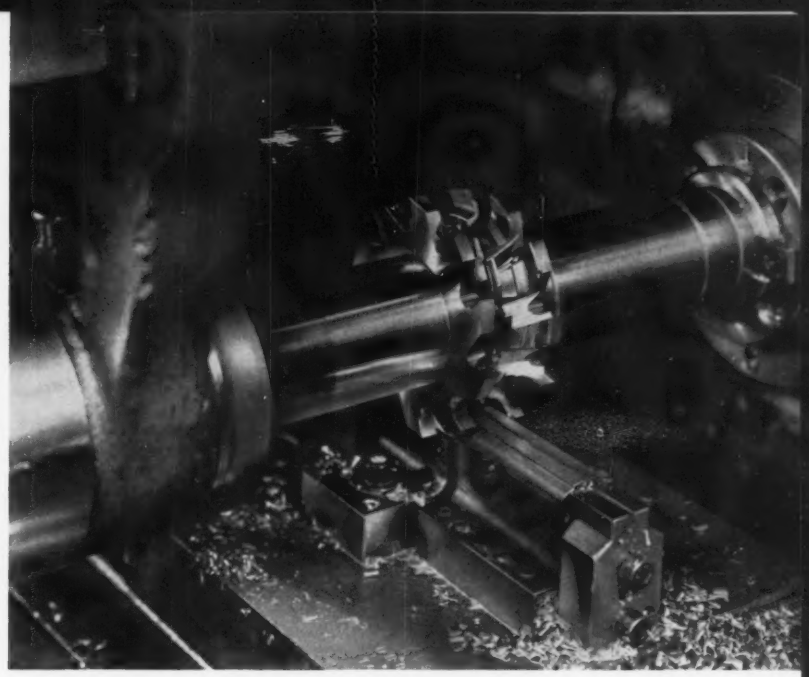


Fig. 3. Outer profile of the lower bearing track shown in Fig. 2 is being machined. The high-rake form cutter, which consists of three interlocking sections, is operated at high speed and feed rates across this steel part.

No appreciable difference in cutter life was noticed between climb milling and conventional milling techniques. Average cutter life between grinds was greater for high-rake tools than for regular tools—also, a better finish and smaller burrs resulted when using the new type cutters. It was found that coolants of the soluble oil type worked to better advantage than cutting oils.

Only one failure was experienced—an attempt to cut a 0.750 inch wide slot approximately 3 inches deep and 7 1/2 inches long. This failure was caused by the inability to get sufficient coolant into the bottom of the slot to keep the cutter teeth cool and lubricated during the entire cut. When the flow of coolant was interrupted for a short period of time, the cutter would seize in the work.

Most of the equipment, including machines up to twenty years old, appeared to be satisfactory and could be used with very little modification. The main factors determining usability of the equipment for high-rake cutters were adequate spindle speed, minimum spindle backlash and table play, and adaptability to the use of coolants.

Milling Machines Adapted for Wider Use of High-Rake Cutters

Working with the information gained from the experimental runs, a program was undertaken to prepare the milling machines for a wider application of cutters designed with high rake angles. As a part of this program, all arbors were carefully checked and straightened so that runout did not exceed 0.001 inch. Badly scored arbors were either repaired or replaced; some were turned down to the next smaller size.

All arbor bearing collars were checked, and those that were more than 0.003 inch under size had the outside diameter built up by chrome-plating. Spacers were face-ground to remove burrs and to make sure that the faces were at right angles to the mounting hole. Arbor support-arm bearings were checked and replaced where excessively worn. On several machines capable of high spindle speeds the brass bearings in the arbor support arms were replaced with Jergens bushings. These bushings are provided with sealed tapered roller bearings.

The subject of coolants was also given prominent consideration. Small-diameter coolant lines were replaced with lines ranging in diameter from 1/2 to 1 inch, depending on machine size. Nozzles were provided to direct the flow of coolant into the cut. This program was extended over a period of several months in order to minimize interference with normal production operations.

High-Rake Cutters Show Greatly Improved Performance

To clearly illustrate the performance of high-rake milling cutters, several different operations will be presented. One application is in the form-milling of a lower bearing track, Fig. 2, for use in a rivet pull-gun. The complete outer profile (shown in heavy lines) is machined in one pass.

In Fig. 3 can be seen the form cutter for the job mounted on the arbor of a Sundstrand Rigid-mil. The cutter is made up of three sections. One section forms the right-hand profile of the part consisting of the edge, the 1/8-inch radius, the 0.975- to 0.985-inch radius, and the 0.995- to 1.005-inch radius. A second section duplicates

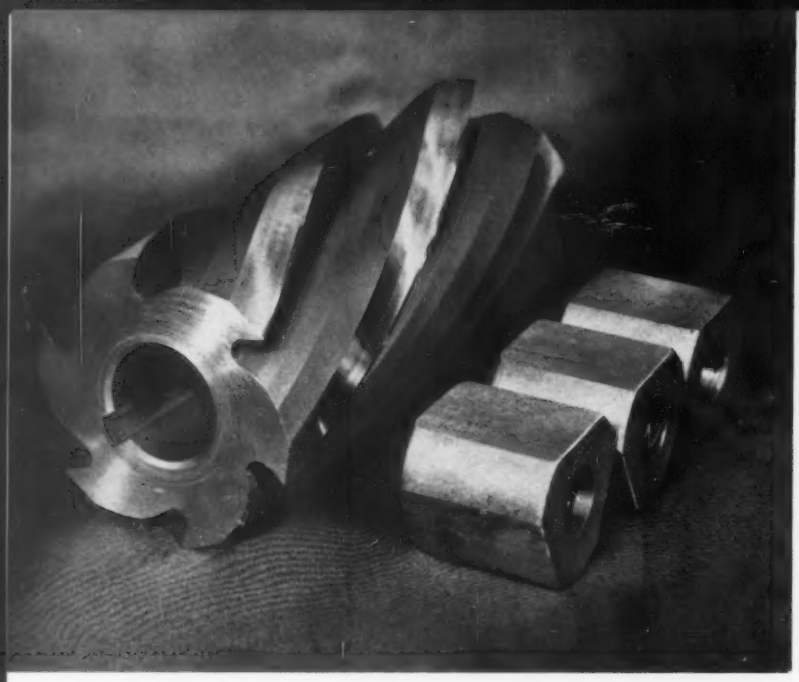


Fig. 4. A helical plain milling cutter having an unusually high rake angle of 25 degrees is now being used to mill one flat on each of three clutch dog cages at the same time. The cutting speed has been increased approximately 95 per cent.

these cuts on the left-hand profile of the part. Sandwiched between these two elements, and interlocking with them, is a grooving cutter that forms the tapered 3/64-inch radius slot. The teeth are ground to a rake angle of 20 degrees. It can be noticed that the chips formed by this cutter have the appearance of thin shavings because they are sliced, rather than pushed, from the work surface.

Partially machined tracks of SAE 8620 steel are located in the 0.625- to 0.631-inch wide channel on a fixture and are pinch-clamped in place. They are climb-milled, with the cutter rotating at a speed of 202 surface feet per minute. The machine table is fed past at a rate of 10 inches per minute, resulting in a floor-to-floor time per piece of 1.3 minutes. This is a very favorable rate compared to the original machining factors of 128 surface feet per minute, with a feed rate of 1 3/4 inches per minute, yielding a time per piece of 4.7 minutes.

A helical plain milling cutter embodying the high rake angle principle is shown in Fig. 4. In front of the cutter can be seen three partially completed clutch dog cages that are used in an impact wrench. To machine the flats, three 2.157- to 2.160-inch diameter cages are placed in a fixture on the table of a milling machine at the same time. They are located by means of a 0.250 plus 0.001 minus 0.000-inch diameter construction hole extending 3/8 inch deep into one face of the parts. This hole is later opened up and reamed completely through the cage.

One flat on each of the three clutch dog cages is machined at a time. The parts are then indexed by hand and the second flat cut, the same procedure being followed for the third flat surface.

Both the helix angle and the rake angle of this 4-inch diameter by 8-inch long milling cutter are 25 degrees. Normally, the helix angle would be the same, but the rake angle would be approximately 10 degrees. With the cutter operating at 186 surface feet per minute and the table feeding at a rate of 9 inches per minute, three flats are machined on the SAE 4140 leaded steel parts in 1.95 minutes. Thus, by using the high-rake cutter it was possible to almost double the original rate of 96 surface feet per minute. Former feed rate was 3.8 minutes.

In Fig. 5 can be seen the machining of an SAE 4815 drop-forged steel clutch dog for a rotary impact wrench. The high-rake form cutter being used shapes the inner profile and flanks of the part—consisting of two 0.906- to 0.908-inch radii, two 0.040-inch radii, and a 0.447- to 0.449-inch radius groove—as indicated by heavy lines in the side view in Fig. 6.

Two work-holding fixtures are bolted to the table of a Sundstrand Rigidmil. Each fixture accommodates one clutch dog which is located by a pin inserted into the 0.3452- to 0.3457-inch diameter hole. With the 4 1/2-inch diameter one-piece form cutter (having a rake angle of 19 degrees) rotating at a speed of 243 surface feet per minute, the table is fed past for a conventional milling cut at the rate of 8 inches per minute. This is a substantial increase over the former surface speed of 69 feet per minute with a feed rate of 2 inches per minute.

A noticeable decrease in the cutting time has also been effected. Whereas 1.3 minutes were formerly necessary to complete the cut, it is now being accomplished in 0.8 minute. The surface finish of the groove, as recorded by a Brush

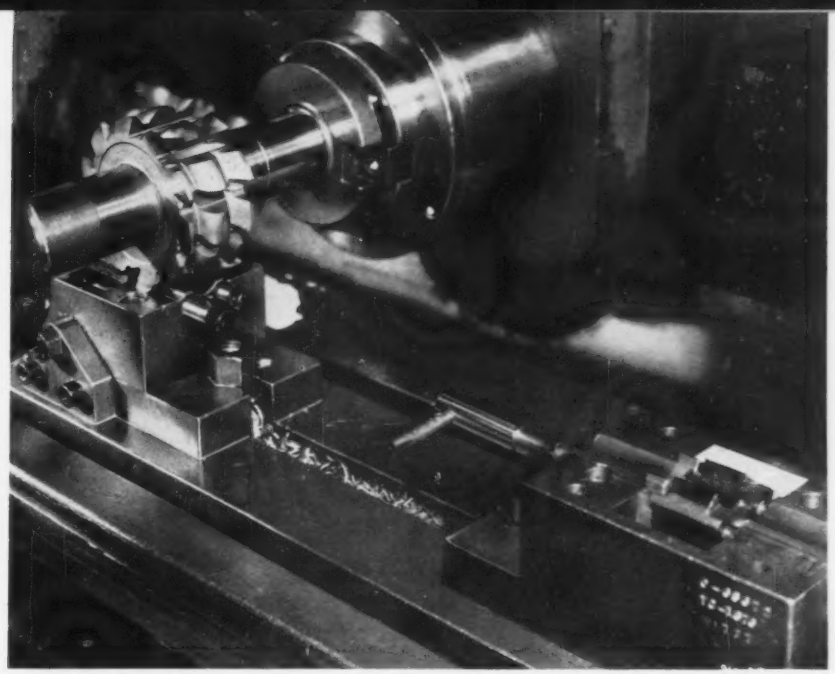


Fig. 5. Form-milling flanks and inner profile of a drop-forged steel clutch dog. Surface finish, employing this solid high-rake form cutter, is held to an average of 12 micro-inches.

surface analyzer, averaged 12 micro-inches. It should be noted that the flow of coolant has been shut off in Fig. 5 for the sole purpose of showing the cutter more clearly.

A milling operation of a more complicated nature is involved in the machining of a stationary punch die for a pneumatic pressing tool, Fig. 7. Although the part is small—about 33/64 by 3/4 by 1 1/16 inches—twenty-five tapered teeth and two wider protrusions must be shaped on its upper surface. The basic shape of the teeth is formed by the two high-rake form cutters illustrated.

Prior to taking the first tooth-forming cut, the bottom channel is machined along strips of Ketos tool steel. The cutter at left-hand side in Fig. 7, having a rake angle of 26 degrees, is then used to shape six rows of serrations lengthwise along the top surface of each strip. Following this, the individual parts are cut off from the strip in lengths of 0.508 to 0.512 inch.

Cross-serrations are machined with the cutter shown at the right-hand side in the illustration. The cutter is designed with a rake angle of 26 degrees. This cut completes the tooth shape as desired. With the exception of a few additional cuts to remove unwanted teeth and to reduce the height of other teeth, the upper surface of the work-piece can be considered finished. The stationary punch die was tooled in this way from its inception. Because of this, a comparison cannot be made between machine settings used with high-rake milling cutters and those used with any previous setups. To give an idea of what is being

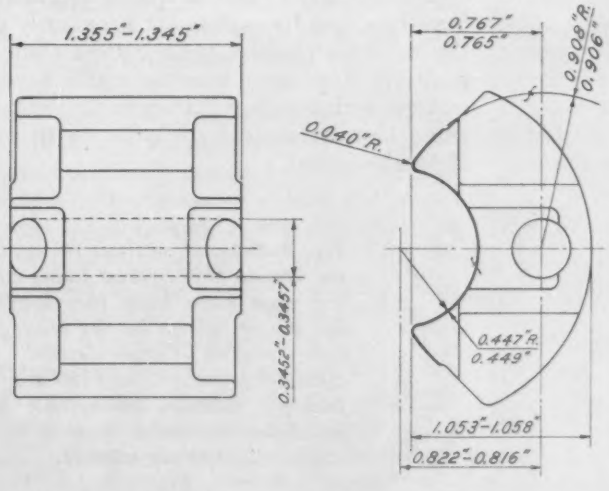


Fig. 6. Clutch dog for an impact wrench is forged from SAE 4815 steel. The contour denoted by heavy lines is cut in one pass by 4 1/2-inch diameter form cutter illustrated in Fig. 5. A rake angle of 19 degrees is ground into the tool.

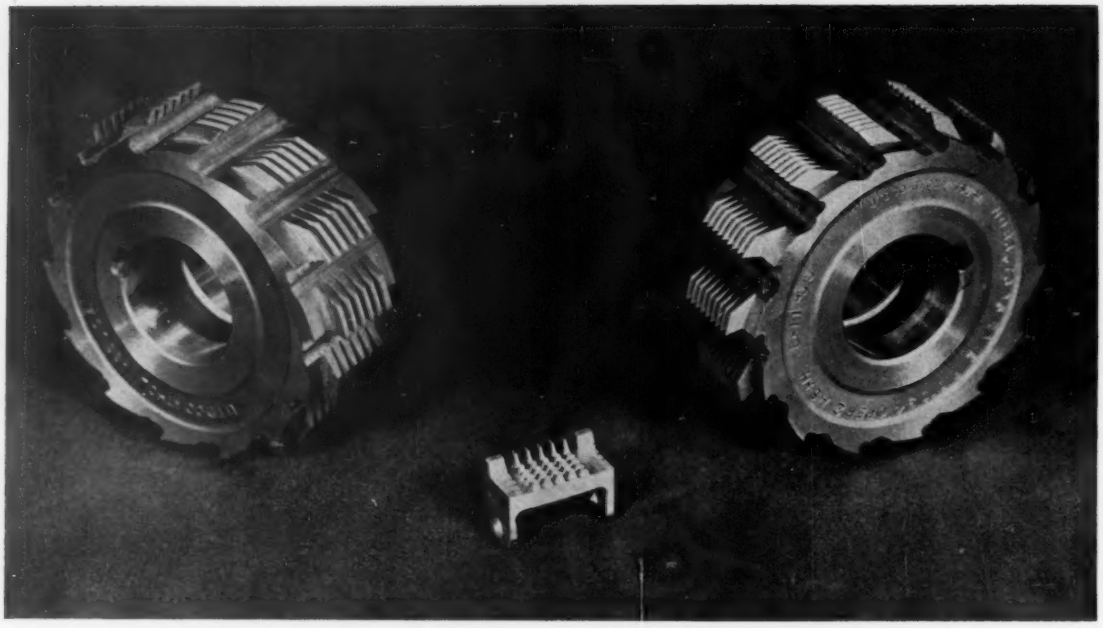


Fig. 7. Machining of several rows of tapered teeth on the upper surface of this part involves the use of these two high-rake form cutters. Both cutters have a rake angle of 26 degrees, each of them forming serrations in one direction.

done, however, it can be mentioned that the form cutter (right, Fig. 7) used to mill the cross-serrations is operated at a speed of 114 surface feet per minute with a feed of 4 inches per minute. Another advantage gained with the high-rake cutters is that no deburring is required after either milling operation.

An instance where the cutting speed was tripled is in the machining of a lower bearing cage for a rivet pull-gun, Fig. 8. The 0.433- to 0.441-inch wide slot in the bronze part was milled at a speed of 392 surface feet per minute with a table feed of 4 inches per minute. A check of the machine was made in accordance with the points brought out previously for the efficient application of high-rake cutters. After such a slotting cutter (36-degree rake angle) was mounted on the arbor, it was found possible to increase the cutting speed to 1180 surface feet per minute and to increase the table feed to 30 inches per minute without sacrificing either total tool life or tool life between grinds.

Resharpening these cutters presents no problem. It can be accomplished on the same equipment that is used for grinding conventional cutters, and can be handled by the same operators. The only precaution necessary is to hold the original rake angle. Cutters are usually pulled from the machine when they show a wear land ranging from 0.010 to 0.015 inch. They are then reground only to a point where 0.002 to 0.004 inch of the wear land is still visible.

In fairness, it should be brought out that the magnitude of the gains in speeds and feeds that have been put forward is not necessarily due to the use of high-rake angle cutters alone. It is probable that some increase could have been realized with standard cutters in the light of machine improvements made prior to the use of high-rake cutters.

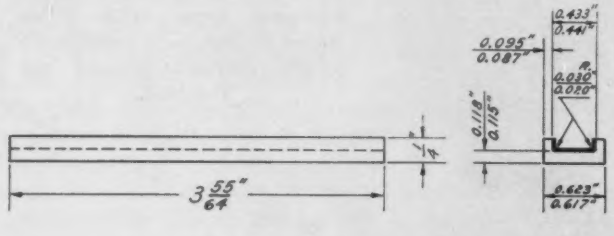
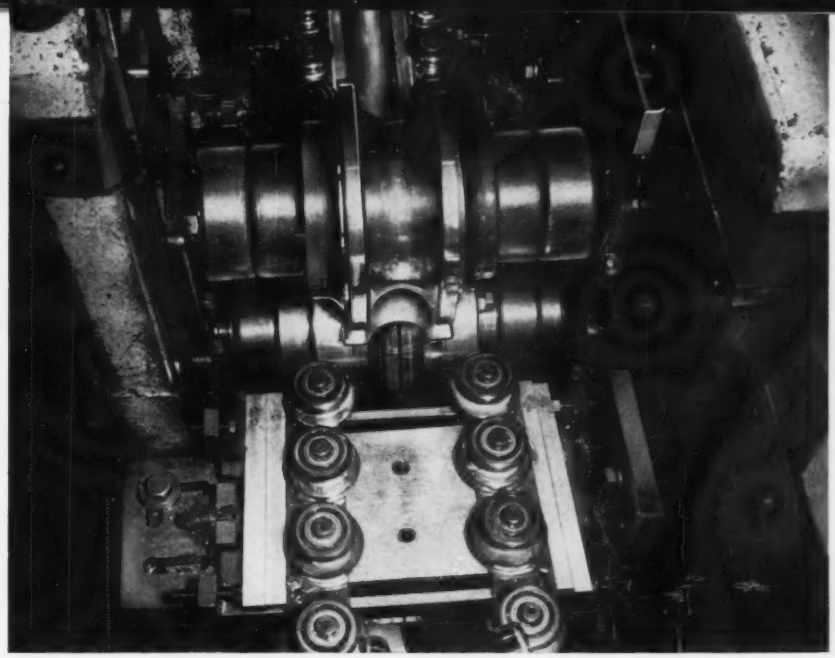


Fig. 8. Machine settings for milling the slot in this bronze lower bearing cage have been increased by the use of cutters having 36-degree rake angles. Cutter speed has changed from 392 to 1180 surface feet per minute, while table feed has been increased from 4 to 30 inches per minute.



Rolling "Hats" from Tapered Strip

By C. H. BEATTIE, Tool Engineer
Santa Monica, Calif., Division
Douglas Aircraft Co., Inc.

ALUMINUM strip which tapers in thickness along its 30-foot length is cold-rolled to a perfect hat-shaped section through the use of a split male die. The operation is performed on a Yoder cold roll-forming machine at Douglas Aircraft's Santa Monica, Calif., Division. Thickness of the strip, part of a horizontal stabilizer, varies from 0.035 inch at one end to 0.070 inch at the other. The heading illustration shows the strip emerging from the final pair of rolls of the machine.

Designers originally specified tapered strip in order to obtain the necessary rigidity at the root end of the structure and, at the same time, to save weight at the opposite end, where the strength factor is only one-half as critical. A problem in forming developed when the tapered strip was rolled on existing equipment.

Since the strip varied in thickness, it was not confined completely in the normal clearance space between the male and female dies as it advanced through the rolls. After subsequent heat-treatment, the strip was straightened on a

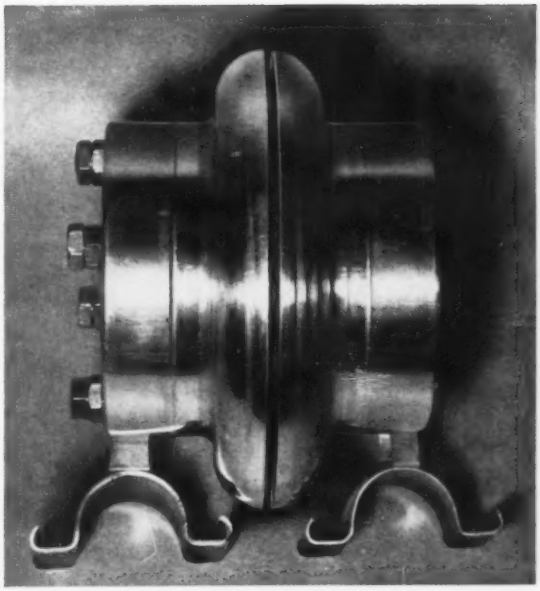


Fig. 1. The male roll die consists of two half sections, separated by a neoprene washer.

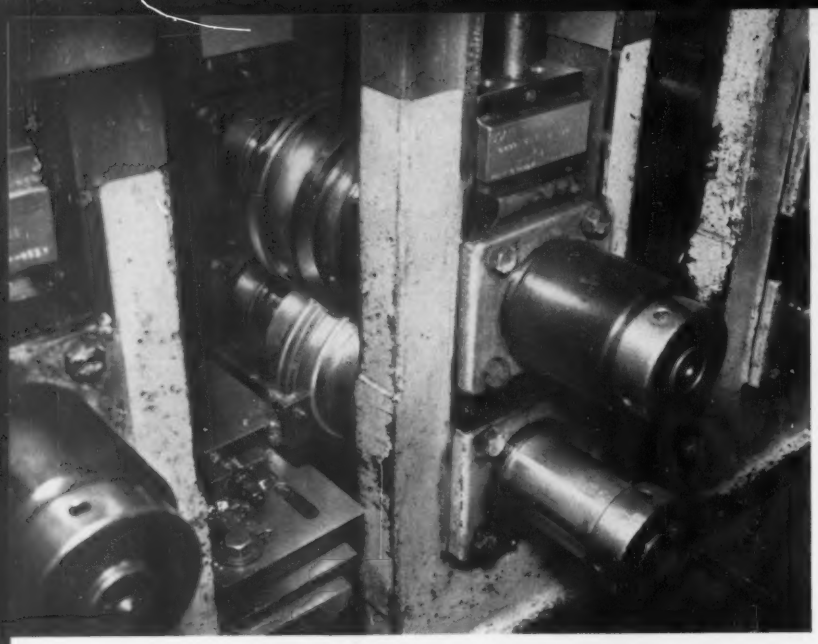


Fig. 2. Rubber cushions between the top roll bearing shaft and its adjusting screws provide a constant pressure on the work.

stretch-leveling machine. At that point, an undesirable nonuniform elongation occurred—from a slight amount at the thick end to an excessive amount at the thin end.

An attempt to compensate for the taper was made by manually adjusting the rolls of the machine for the final passes, but the improvement was insufficient for production requirements. Furthermore, in the stretch-leveling, tolerances were not held satisfactorily.

The tooling department then designed a split male roll die, the halves of which were separated by a washer of sheet neoprene of 50 Shore hardness. The die is illustrated in Fig. 1. (Hat sections from each end of the strip are seen immediately below the die.) In its normal expanded condition, the male roll die adequately fills the female cavity, with sufficient clearance for a strip thickness of 0.035 inch.

During the operation, the strip advances through the machine, thin end first, and the male die keeps contracting to accommodate the increasing thickness of the strip. Proper roll-forming is possible if constant pressure is maintained between the rolls. To keep this constant pressure—roll for roll—and still compensate for the varying stock thickness, a box containing a rubber cushion is located in each side of the machine, between the top roll bearing shaft and its adjusting screws, as shown in Fig. 2.

Tooling for the stretch-leveling consists of two clamping stations, one of which appears in Fig. 3. The stations assure uniform elongation over the entire strip length. The top section of each station is of hardwood, and matches the external contour of the hat section. Cylindrical filler blocks are of duralumin, turned to increments of 0.006 inch on the diameter and anodized.

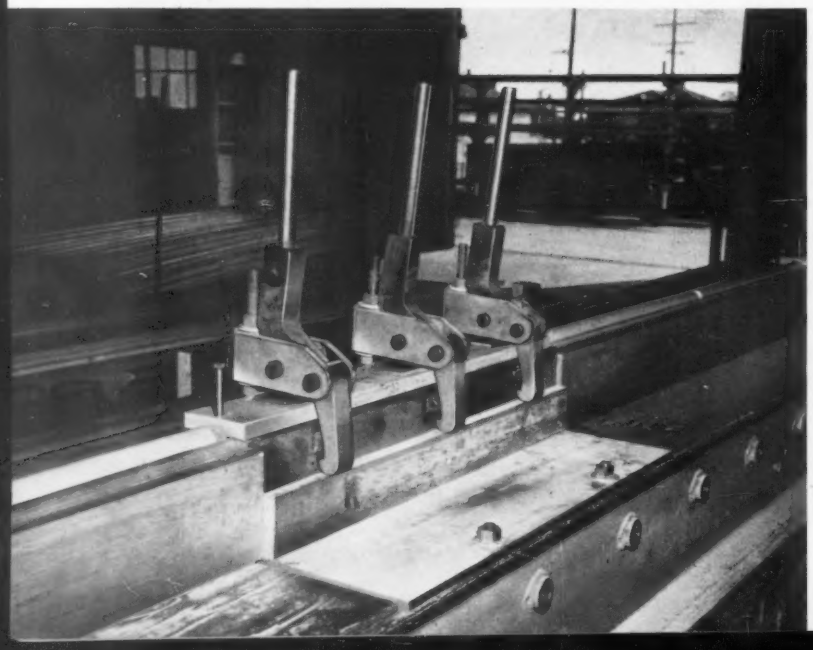


Fig. 3. One of the two clamping stations providing uniform elongation of the strip during the stretch-leveling operation.

Making Equipment Replacement Pay Off

By F. S. CORNELL
Executive Vice-President
A. O. Smith Corporation
Milwaukee, Wis.

COMING up with equipment replacement ideas at A. O. Smith is the job of every employe. This is just one phase of a continuous drive to improve product quality and reduce costs and, at the same time, improve job conditions and safety. Given the proper organizational emphasis and stimulation, equipment ideas can be plentiful. Carrying out some of these ideas becomes a matter of getting the most effective use from the money invested, and the priority of proposals with relation to the amount of capital funds available has to be determined. Replacement is not always the best answer. Sometimes a closer look at the problem indicates that major overhaul is sufficient for the application, or may point to an entirely different way of doing things.

While new products or process changes are major factors in creating a need for replacement of machines or equipment, a wide range of other opportunities exists. Not only are the production engineering, plant engineering, and tooling organizations involved, but recommendations come from production supervision and cost reduction teams that consolidate ideas of the various departments involved.

Profit Improvement Committees in each of the product divisions at A. O. Smith have proved very effective. Specific equipment proposals resulting from such effort are reviewed after all the facts have been gathered, and recommendations are made for their inclusion in the capital budget. Not all proposals are of a capital nature, and worthwhile recommendations dealing with minor changes in production methods and the use

Fig. 1. Central Staff Machine Tool and Equipment Committee of A. O. Smith Corporation is shown in session. Left to right are Sig Rudorf, technical assistant to the vice-president in charge of manufacturing; Walter Froderman, in charge of purchasing for buildings and equipment; Elmer Widerborg, manager of the General Services Division, which includes the tooling production center; and P. A. Scheuble, administrative assistant.

of small tools are taken care of by the operating budget. Sometimes it cannot be afforded not to adopt them.

One of the first steps in developing a potential equipment idea is to determine the best equipment for the job. The procedure for this varies among the company's eighteen divisions, but essentially involves close coordination between the shop, engineering department, purchasing department, and equipment manufacturers. Special equipment problems involve the company's Central Tooling and Equipment Design Groups.

Wide coverage of the metalworking industry by means of field trips and perusal of trade magazines and manufacturers' literature is deemed essential to prevent insulation of the technical

Fig. 2. (Below) Machinery and Equipment Analysis form comparing two existing planers with proposed purchase of new planer type mill.

A. O. SMITH Corporation
D-1040 Rev. 2 Fin.-Fin.Assets

MACHINERY AND EQUIPMENT ANALYSIS

PRESENT EQUIPMENT		NEW EQUIPMENT	
Manufacturer	Two (2) Planers	Manufacturer	
Type and Size	4' x 4' x 20' and 3' x 3' x12'	Type and Size	
Machine No.	2523 2906	Model Description	OVERHAUL OF PRESENT EQUIPMENT
Year Built	1927 1930	Estimate by	Date

ANNUAL AVERAGE OPERATING COMPARISON OF PROPOSED ALTERNATIVE vs. PRESENT EQUIPMENT

COST ITEMS	Savings of proposed over present	Additional Costs over present
1. Direct Labor	$	$
2. Indirect Labor		
3. Fringe Benefits (Use 15% of 1 and 2)		
4. Maintenance and Repair (exclude major overhaul)		
5. Tools (Production, durable and perishable)		
6. Scrap and Rework		
7. Down Time		
8. Power Costs		
9. Subcontract Cost		
10. Property Taxes and Insurance		
11. Other items such as: income increase due to increased capacity (if utilized), material cost, cost of space (if significant) Specify		
Total	$ (A)	$ (B)
12. Annual Gross Savings of proposed over present (A minus B)	$	

NOT SIGNIFICANT

A. O. SMITH Corporation
D-1040 Rev. 2 Fin.-Fin.Assets

MACHINERY AND EQUIPMENT ANALYSIS

PRESENT EQUIPMENT		NEW EQUIPMENT	
Manufacturer	Two(2) Planers	Manufacturer	PLANER TYPE MILL
Type and Size	4'x4'x20' and 3'x3'x12'	Type and Size	54" x 54" x 20 Ft.
Machine No.	2523 2906	Model Description	
Year Built	1927 1930	Estimate by	W. Adamson Date 5/25/55

ANNUAL AVERAGE OPERATING COMPARISON OF PROPOSED ALTERNATIVE vs. PRESENT EQUIPMENT

COST ITEMS	Savings of proposed over present	Additional Costs over present
1. Direct Labor	$ 19,760	$
2. Indirect Labor		
3. Fringe Benefits (Use 15% of 1 and 2)	2,965	
4. Maintenance and Repair (exclude major overhaul)	1,500	
5. Tools (Production, durable and perishable)		1,000
6. Scrap and Rework		
7. Down Time		
8. Power Costs		Not major
9. Subcontract Cost	15,000	
10. Property Taxes and Insurance		2,400
11. Other items such as: income increase due to increased capacity (if utilized), material cost, cost of space (if significant) Specify		
Total	$ 39,225 (A)	$ 3,400 (B)
12. Annual Gross Savings of proposed over present (A minus B)	$ 35,825	

CAPITAL COST ANALYSIS

PRESENT EQUIPMENT		NEW EQUIPMENT (or alternative of overhaul) * (Est. time before major overhaul)	
13. Resale, Salvage or Conversion value	$ 15,000	17. Anticipated Service Life	15 * years
14. Remaining useful life for this application before necessary major overhaul	Must overhaul soon years.	18. Cost of Equipment (Include engineering)	$ 165,000
15. Cost of major overhaul	$ 10,000	19. Installation and rearrangement cost	1,500
16. Useful life after overhaul	8 years.	20. Cost of additional items needed to service equipment	7,000
NOTE: Attach separate Machinery and Equipment Sheet for alternative of overhaul.		21. "Going-in" Costs	
		22. Other expensed items	
		23. Total cost of replacement	173,500
		24. Subtract item (13)	15,000
		25. Net cost of replacement or overhaul	158,500

SUMMARY (See Instructions)

NUMBER OF YEARS TO RETURN INVESTMENT		AVERAGE NET SAVINGS DURING SERVICE LIFE	
26. Required % return on investment	20 %	28. Annual gross savings - From (12) above	$ 35,825
27. Number of years to return investment at % required return (Use Nomogram)	11 years	29. Less average anticipated repair costs	600
		30. Adjusted gross savings (28) minus (29)	$ 35,225
		31. Annual savings required to give desired return for period of anticipated service life in (17) above (Use Nomogram)	33,000
		32. Annual average Net savings during anticipated service life (30 minus (31)	$ 2,225

Comments: Item #27 falls within risk period of utilization and still provides for 20% return on investment. When comparing overhaul versus buy situation, Item #32 is plus $2,225, as compared to minus $3,000 for overhauling old equipment. Purchase is desirable.

(See attached analysis for overhaul)

Approved by

COST ANALYSIS

NEW EQUIPMENT (or alternative of overhaul)

17. Anticipated Service Life	8 years	
18. Cost of Equipment (Include engineering)		$ 10,000
19. Installation and rearrangement cost		
20. Cost of additional items needed to service equipment		
21. "Going-in" Costs		
22. Other expensed items		
23. Total cost of replacement		
24. Subtract item (13)		
25. Net cost of replacement or overhaul		$ 10,000

(See Instructions)

AVERAGE NET SAVINGS DURING SERVICE LIFE

28. Annual gross savings - From (12) above		$ 0
29. Less average anticipated repair costs		250
30. Adjusted gross savings (28) minus (29)		$ (250)
31. Annual savings required to give desired return for period of anticipated service life in (17) above (Use Nomogram)	2,750	
32. Annual average Net savings during anticipated service life (30 minus (31)		$ (3,000)

Approved by

Fig. 3. (Above) Alternative of overhauling the two existing planers is analyzed on this form. A loss of $3000, as shown by Item 32, would result from such action.

people from new advances. Tied in with the evaluation are the associated problems of space requirements, installation costs, the need for auxiliary equipment, and the timing involved, Emphasis is placed upon actual performance tests and observation of the machine in action to determine the feasibility of a proposal.

Selection of Replacement Equipment

The actual process of selecting new equipment varies widely, but should incorporate certain basic steps. It is easy to fall into habit patterns, such as replacing a worn milling machine with one larger and more powerful, without studying the actual processing of the work-piece. This should always be done to determine if the technological progress which has been made since the first machine was bought might not make it more desirable to broach instead of mill, or precision-cast to size instead of machining at all. It is preferable to consider first the products, then processes, and, finally, the equipment to carry out the process.

Once this is established, it is necessary to arrive at a mental picture of the desired piece of equipment. In many cases, a specialized piece of equipment is indicated. When the shop and engineering people have pooled their thoughts, and several alternatives present themselves, preliminary discussion with equipment builders may prove stimulating and informative. At some point, however, a specification of what is desired must be prepared. It is unfair and impractical to call machine tool builders into a plant and expect them to ferret out facts and referee diverging demands. This leads to wasted effort in the preparation of proposals, to widely differing concepts among competing vendors, and, consequently, to quotations which are not comparable.

Vendors should be approached with a clearly stated problem, and, perhaps, sketches or specification sheets showing the dimensional range necessary. Also, the desired capacity in terms of horsepower, required speeds and feeds, durability of construction, and the anticipated service life should be given. Then, the vendors can compete on a fair basis, without compromising their individuality in executing the detailed design. When bids are received, whether the equipment is specialized or standard, it is well to prepare a comparison sheet, where the features offered by each builder are compared to each other and to the specification. Such items as vendor reputation, delivery, costs, and financial arrangements (such as progressive or advance payments), in addition to purely mechanical matters, should receive consideration.

Objective Analysis of Performance Important Factor

Insofar as practical, an objective determination is made of the operating expense, including quality, as represented by the amount of scrap produced, the number of parts requiring rework, and inspection costs. Furthermore, attention is given to the potential volume of work that can be produced, since utilization of the equipment will determine, to a large degree, its economic necessity. Possible increase in income through increased capacity is also considered.

Often, cost savings and increased income are not sufficient to justify a replacement. However, if major overhaul of the present equipment is imminent, such costs may be the deciding factors for replacement. Too much emphasis on cost factors presents the danger of neglecting practical aspects, and as many of the intangibles as possible should be eliminated. The final answer, of course, must be based on judgment, using the cost factors as a guide. The results of the analysis are summarized on a Machinery and Equipment Analysis form which will be described and illustrated later in the article.

Review of Replacement Recommendations

To get the maximum benefit of company-wide experience in equipment selection and purchase, proposals are reviewed by a Central Staff Machine Tool and Equipment Committee, Fig. 1, which is comprised of representatives from the manufacturing vice-president's staff, the General Services Division, and Purchasing Department. This committee does not originate equipment requests, but reviews requests submitted by the divisions. Such a review covers a consideration of the need, the best equipment for the job consistent with cost and future requirements, alternate methods, an evaluation of the economics, and possible use of equipment located elsewhere in the company. Some flexibility in the operation of the committee is maintained, and it also has an interest in the proper maintenance and usage of equipment. Generally, the committee meets with the various divisions to review their equipment programs, prior to submittal as a capital expenditure program.

A method for budgeting capital equipment expenditures is necessary to plan effective allocation of funds. This is achieved by each division developing an advance plan for equipment needs in detail, and fitting each division's requirements in with an over-all plan that produces the most effective use of capital. Projects are arranged in order of importance, which allows flexibility in planning. The advance plan for a specified dollar

amount is approved by management, against which individual project requests are submitted for approval as the project planning becomes firm. This presents a more realistic picture of future expenditures. However, final approval by management of each major expenditure must be obtained through an appropriation request, after screening against the advance plan and review by the Central Staff Machine Tool and Equipment Committee.

Economic Analysis of Proposed Replacements

The link between shop requirements and financial considerations is provided by an economic analysis of the proposed replacement. While there are various methods of equipment replacement analysis available, none seemed adequately suited for the needs of the A. O. Smith Corporation. It was felt, a method was needed that would supply simple and understandable rules, so that various proposals could be compared with regard to capital availability, and their acceptance or rejection explained.

The method currently being used was developed to emphasize the company's viewpoint on utilization, return on investment, and overhaul-versus-buy situations, while at the same time drawing upon well-established principles used for many years in financial and engineering economy studies. The physical and economic factors are related in a simple and realistic manner. At the same time, the method has enough flexibility to permit the evaluation of estimates and assumptions to provide the best use of judgment. The arithmetic is made simple and understandable by using a house mortgage concept, where the equipment pays back the investment plus interest (return on investment) to management through its savings and increased income. The calculation is made easy by the use of a nomogram which requires only a straightedge for solution.

An actual case history will illustrate the functioning of the process. The general foreman of the Tool Division, a large operation at A. O. Smith, realized that present planer operations were not the fastest way to cut chips, in view of available planer type mills. Not only was the cost higher, but additional capacity was needed. Visits to various shops confirmed this, and it was decided to go into greater detail.

Various machine tool manufacturers were contacted, and prints of typical jobs were given them for quotations on guaranteed production times. The Tool Division worked closely with the machine tool manufacturers to establish the exact requirements. This information was presented to the Tool Division Profit Improvement Committee, a committee organized to act as a clearing house for profit improvement ideas. The potential looked good, and it was decided to work up a detailed economic analysis on the Machinery and Equipment Analysis form, Fig. 2. This was done jointly by the toolroom superintendent, the division accountant, and the division manager, who was in a better position to estimate the potential work the new machine tool might handle.

Savings were based on direct labor costs and the fact that increased capacity would allow work that was presently subcontracted to be done in the shop. While savings were appreciable, the clincher was the expenditure that would be required for overhaul of the old equipment. The effect of overhaul on annual costs shows up as Item 32.

Actually the analysis consists of two alternatives: overhaul of the old equipment or the purchase of a new machine. Therefore, an analysis form was prepared for both cases, as seen in Figs. 2 and 3. The service life of the new equipment was taken as the estimated time before major overhaul would be required, since the equipment is considered to be in the replacement zone at this stage. It can be shown that, for all practical purposes, various service lives selected in this zone will not cause significant differences in the resulting net savings. A nomogram, Fig. 4, is used in the calculation.

The economics being proved, the next step was the actual selection of the equipment. A comparative chart, Fig. 5, was developed for five different possibilities, which showed all pertinent specifications of different builders' machines. This information was presented to the Central Staff Machine Tool and Equipment Committee, and a final selection was made by joint agreement among the members.

The purchasing department is represented on the Machine Tool and Equipment Committee and works closely with the divisions in getting the best equipment for the job. This approach also ties in with perishable tools such as grinding wheels, drills, and cutters. Close touch is maintained with vendors to keep abreast of latest developments.

The Division Accounting Department prepared the project request form, Fig. 6, which is the official request for management approval. The Machinery and Equipment Analysis form is attached. Upon approval of the project and the appropriation, the division can place the equipment on order.

Generally, there are two basic replacement situations:

1. The present equipment can no longer do its job because of wear, and a decision must be made

whether to spend money on a major overhaul or replace it with the same or better equipment. A decision is mandatory.

2. Factors other than wear enter into the picture, such as obsolescence, and cost savings or increased productivity makes replacement of the equipment appear attractive.

Actually, both basic situations are present in varying degrees in most any replacement problem. Furthermore, the term "equipment replacement" can be broadened to include practically any situation where costs can be reduced or profits increased by an expenditure.

While the illustrative problem is self-explana-

A. O. SMITH Corporation
O-1270 Rev. 5 Fln.-Ac-Rpt

CAPITAL EXPENDITURE PROJECT REQUEST AND APPROPRIATION REQUEST

Unit Requesting: GENERAL SERVICE DIVISION
Project Number: 026 GR-2
Type of Request (CHECK ONE): Original Project Request $ 166,000; Increase of Existing Project; Total $ 165,000
Date of Request: June 15, 1955
Recorded in Office of the Controller: 6-28-55 (Date) (Initials)

Project Classification and Amount

Check One		Plant and Equipment	Dies, Jigs and Fixtures	Durable Tools
☐	BR - Normal Replacements			
☐	NP - New Products			
☐	X - Expansion of Capacity			
X	CR - Cost Reduction	$165,000		
☐	NC - Model Changes and Additions			
☐	PII - Plant Improvements			

Description of and Reason for this Project

Purchase and install (1) special design Planer Type Milling Machine with adjustable rail, approximate size 5½' X 5½' - 20 ft.; fully equipped, including two spindle heads and electric equipment.

To replace the following obsolescent equipment:

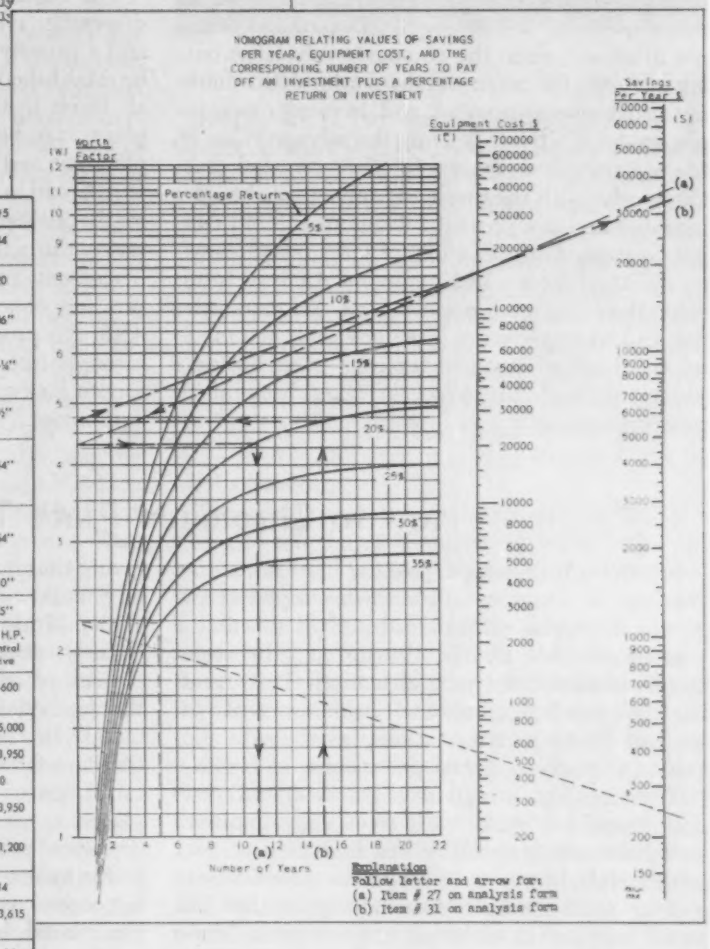
No.	Purchased	Description	Depreciation Status
2523	1927	48"X48" - 20' Planer	Fully
2906	1930	36"X36" - 12' Planer	Fully

Fig. 4. (Below, right) Nomogram used to find Item Nos. 27 and 31 on Machinery and Equipment Analysis form, Fig. 2.

Fig. 5. (Below, left) Chart prepared to compare specifications, price, and delivery of planer type milling machines made by five different builders.

Fig. 6. (Left) Capital Expenditure Project and Appropriation Request form prepared by the Division Accounting Department to request management approval.

Vendor	#1	#2	#3	#4	#5
Overall Length of Bed – Feet	44	44	44	44	44
Length of Table Travel – in Feet	20	20	20	20	20
Width of Table	44"	44"	44"	44"	46"
Max. Distance Top of Table to Center of Side Milling Head Spindle	42-½"	42-½"	–	42-½"	42-½"
Distance Between Housings	56-½"	56-½"	openside	61"	56½"
Distance From Top of Table to Rail Milling Head Spindle Nose	51-½"	51-½"	49-¼"	49-¼"	54"
Distance Between Housing & Right Side Milling Head Spindle Nose	55-½"	55-½"	–	56-½"	54"
Diam. of Quills	10"	8-¾"	12"	12"	10"
Quill Travel	–	–	14"	14"	15"
H.P. Per Milling Head	50	30	40	40	100 H.P. Central Drive
Spindle Speed in R.P.M.	9-500	9-500	10-500	10-500	21-600
Weight in Pounds	137,600	106,400	138,300	122,200	145,000
Prices F.O.B.	$125,040	$ 86,385	$159,470	$157,025	$143,950
Price of Electrics	24,000	18,878	0	0	0
Total Price	$149,540	$105,263	$159,470	$157,025	$143,950
Extra Cost Each Additional 2 Feet of Table	2,100	1,970	–	–	1,200
Shipment in Months	10-12	5-6	9-10	9-10	14
Right Angle Attachment	–	–	–	–	$ 3,615
Remarks	Double Housing	Double Housing	Openside	Double Housing	Double Housing



tory, special attention should be given to several points. The method used emphasizes utilization of equipment, since it requires that the capital return period reasonably correspond with possible use. There is some flexibility here, and it should be mentioned that this is not the so-called "pay-out method." This test of utilization is not generally applied for mandatory situations, since it would be academic in such cases. Loss in sales volume by not taking action overshadows other considerations.

Also, both the purchase of new equipment and the overhaul of existing machines are considered as alternatives to the present situation. The study starts from the present time and is concerned only with what lies ahead, not past history. The annual average net savings during anticipated service life (Item 32) can be used as a guide to determine priority of replacement, within the mandatory and non-mandatory categories. This is a guide only, and should not be a substitute for good judgment.

The anticipated service life for new equipment is based on the probable length of time before major overhaul will be required. Actually, this is not arbitrary, since the comparatively large outlay of funds for major overhaul stimulates thinking about new equipment, and, in many cases, replacement is advisable. Only the salvage value of the old equipment is used to offset invested cash. Obviously, both the predicted salvage of the new machine and the present salvage of the old cannot be used. Also, the effect of taxes is not shown on the Machinery and Equipment Analysis form, since their impact is not clear cut and cannot be reduced to simple rules. The decision is first made on the basis of good engineering and business judgment, with the effect of taxes brought to bear subsequently.

After installation of the new equipment, it is good business to double check actual results against those predicted. Sometimes, results vary widely from estimates. The review is important since it makes for improved judgment, and may aid in avoiding further mistakes. Also, if estimated savings are accomplished, this will encourage further recommendations.

Making Replacement Pay Off

To make equipment replacement pay off, a coherent plan is essential. Such a plan should include an objective study of proposals and support of them by records or reasonable estimates. Periodic check-ups should be made of equipment condition and operating costs; these may signal deterioration. Good working records are required, but they need not be expensive since they usually can serve multiple purposes. A good example is a maintenance record, which can be used both for historical information and as a working record to schedule maintenance.

The economic analysis should consolidate engineering, cost, and financial factors involved, and a priority and timing of replacements should be established. Two-way communication between all levels in the organization is essential so that plans can be correlated with future company planning and capital availability.

A broad management viewpoint is necessary in the allocation of funds for replacement purposes, the setting up of adequate reserves for replacement, and an appreciation of its competitive position concerning the efficiency of its plant. Also, the program should provide proper equipment maintenance and constant supervisory effort to instruct, and thus prevent mishandling of equipment.

How to Chromium-Plate Titanium

A process for electrodepositing hard protective coatings on titanium has been developed at the National Bureau of Standards. After forming a titanium-fluoride film on the surface, the metal can be electroplated with chromium. Heat-treating the plated titanium for two minutes at 800 degrees C. in an inert atmosphere greatly improves the adherence of the chromium coating.

Titanium has a high strength-to-weight ratio and, therefore, ranks with steel and aluminum as a structural material. When in loaded contact with metals, however, titanium has a tendency to gall or seize. Another disadvantage is that this metal oxidizes at elevated temperatures. These undesirable characteristics can be minimized by giving titanium a hard, oxidation-resistant coating of a metal such as chromium. Previous attempts at depositing metals on titanium have not been entirely successful, due to poor adhesion.

Lack of adhesion is blamed on an oxide film that is believed to exist on the surface of the metal. In the recently developed process, the titanium-fluoride coating appears to prevent the formation of the oxide film. When the piece is placed in the plating bath, the titanium fluoride dissolves, permitting the chromium to bond directly to the metal. Similar methods for depositing copper and nickel on titanium have also been formulated, but the adhesion of these metals has not been as successful.

Machining the Blades of 50,000-R.P.M. Turbine Rotors

TO start a jet engine, it must be wound up to 25 to 40 per cent of its operating speed. Only then can its compressor supply the enormous gulps of air required to run the engine. The need for this high initial speed, coupled with the need for a highly favorable horsepower-to-weight ratio, calls for a starting device that is itself a turbine—a case of a small turbine starting a bigger one.

One of the starters in wide use today is made by Hamilton Standard, Windsor Locks, Conn. For a power source, it uses compressed air from a ground supply; or, in the case of multiple-engine jets, it can use an air bleed from the compressor of another engine. The air is directed against the turbine blades in a 1000-mile-an-hour blast, spinning the turbine up to 50,000 R.P.M. Gearing reduces this speed to a suitable starting range. There is a single-direction clutch which automatically disengages the starter when the engine begins to run under its own power. This takes about thirty seconds.

The starter assembly consists of an axial flow turbine, a gear train of approximately 13.6 to 1 reduction from the turbine to the output shaft, the single-direction clutch, and two centrifugal cut-off switches. In addition, there is a combination pressure-regulating and shut-off valve.

One of the most intricate steps in the manufacture of the mechanism is the machining of the blades of the turbine rotor. The blades are integral with the rotor, being cut into the periphery of the rotor with an end-mill. Various models of starters are made, and the blades in each rotor have their own specifications in regard to shape, dimensions, and number.

Blades are of two basic types: straight-cut, in which sides are parallel and thickness is the same from root to tip; and radial-cut, in which each side is radial to the rotor center and thickness increases from root to tip. Movements of cutter and work to obtain the basic blade type required are incorporated in the milling equipment.

The Pratt & Whitney Keller seen in Fig. 1, for example, is used for blades of the straight-cut type. In the illustration, a thirty-one blade rotor has just been completed. The material is a steel forging (AMS 6415) having a hardness of 26 to 32 Rockwell C. Later, it is heat-treated to 38 to 41 Rockwell C.

From root to tip, the blades measure 0.720 inch. The end-mill has a diameter of 0.187 inch—determined by the narrowest point of restriction between blades—and operates at the full depth of cut. It is of high-speed steel, has a four-flute, fast-spiral body, and runs at 2500 R.P.M. At its end, the cutter is ground to produce a 7-degree taper for about one-third the distance up from the root. Being relatively slender, the end-mill has an unavoidable amount of spring. To gain accuracy, therefore, a second, cleanup cut is taken at the same setting.

Milling of the blade profile is automatic, being controlled by the contact of an electric tracer spindle against a master mounted on an angle-plate above the work. Indexing the work from one blade to the next is performed manually.

Machining time averages seven minutes per blade.

Where higher production of straight-cut blade type rotors is indicated, milling is done on the battery of four Thompson automatic profilers seen in Fig. 2. One operator tends all machines. Essential difference in this instance is that the profile is controlled by a cam beneath the table. Also, while the same kind of end-mill is used, it operates at less than full depth for the first cut, then at full depth for the second cut.

An angle-plate supports the rotor directly over the table center. In operation, the table rotates the work and cam as a unit, and moves toward or away from the spindle hydraulically under the direction of the cam. During the non-cutting portion of each cycle, the table is programmed to execute a rapid traverse by lugs on a disc on the side of the machine. These lugs control hydraulic valves.

In the heading illustration is a close-up view taken during the cycling. After the work is indexed manually, the machine automatically cuts the blade, returns the work to starting position, and automatically shuts down. It is then indexed again. Spindle rotation is 3600 R.P.M. Blades are completed at the rate of one every sixteen minutes.

For producing the radial-cut blade type, somewhat more elaborate equipment is necessary. In this instance, the center line of the end-mill must remain radial to the rotor center at all points during the cut. The machine illustrated in Fig. 3 is one of five "helix" mills developed by Hamilton Standard for this purpose.

This work-piece is a thirty-eight blade rotor, with a blade depth of 0.550 inch. Two opposed spindles operate simultaneously, so that the rotor requires only nineteen indexing positions. Carbide end-mills are used. Indexing is automatic, permitting the entire operation to be performed rapidly.

The blade form is generated by a combined axial and rotative feed of the work across the path of the cutters. At the start of the cut, the forward face of the rotor is behind the end-mills,

Fig. 1. This view of the tracer-controlled profiler shows a rotor after all of its thirty-one blades have been cut.

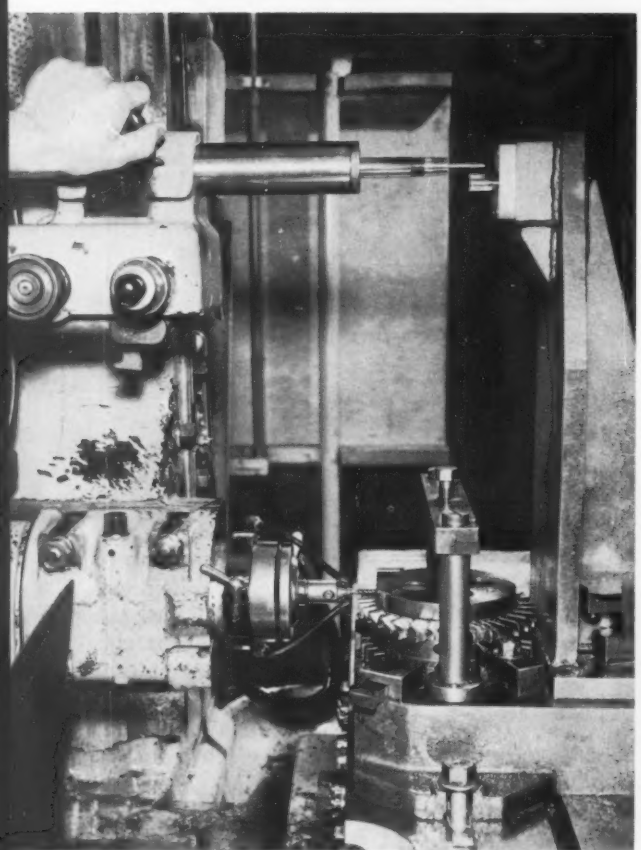
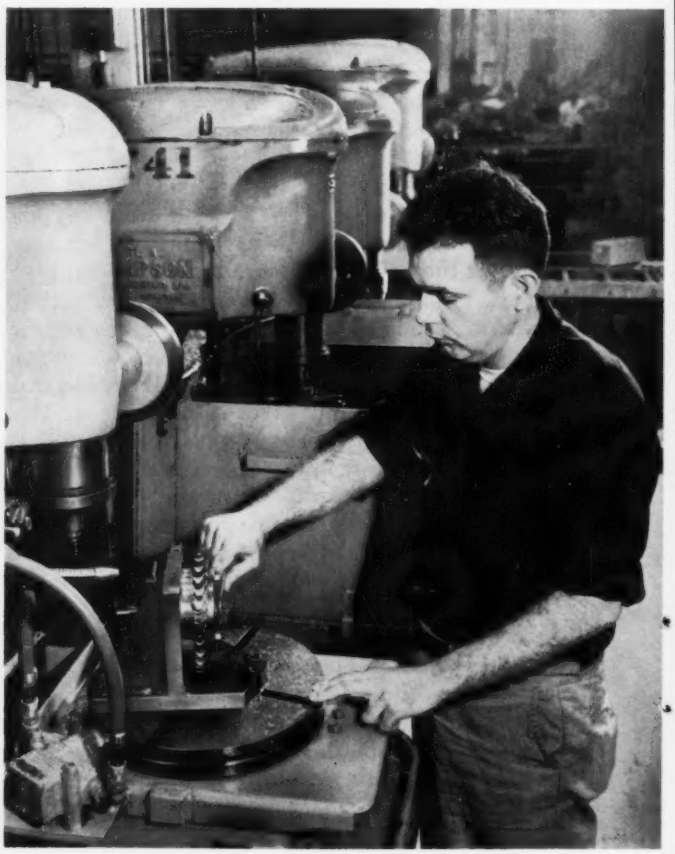


Fig. 2. The operator is removing a completed straight-cut blade type rotor from a cam-controlled vertical profiler.



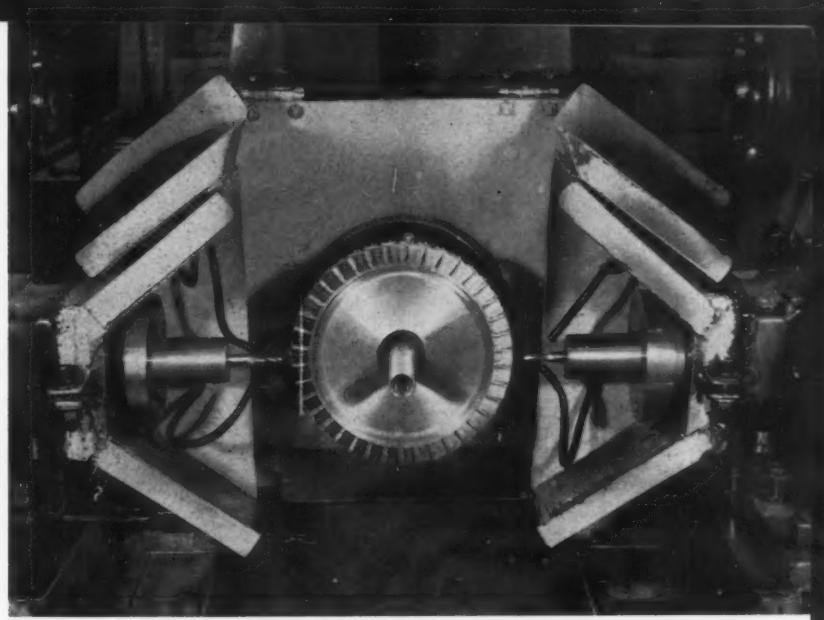


Fig. 3. This "helix" machine has two opposed spindles which simultaneously mill radial-cut blades.

and the spindles advance toward center until both cutters are at proper depth. Then, with the spindles revolving around a fixed center line, a cam produces the axial and rotative feed of the work. This continues until the cutters emerge from the rear face of the rotor.

Next, the spindles proceed to retract, and the combined movement of the work is reversed. The cycle is completed with an automatic indexing of the work to the next blade positions. Cycle time for each two blades amounts to sixteen minutes. All thirty-eight blades are first roughed out, cutters are then changed, and the blades are finished.

Radial-cut blades are also being produced on a Kearney & Trecker special multiple-spindle machine. Five rotors are processed simultaneously. In this instance, the rotors are stationary during the cut, and all feed movements are incorporated in the cutter spindles.

Tolerances at all points of contour for all rotors are held within plus or minus 0.003 inch. In later operations, the rotors are balanced and heat-treated, and blades are given a 0.006- to 0.009-inch chromium-plating to prevent erosion. For some of the rotors, the blades are shot-peened to provide added strength.

* * *

National Bureau of Standards to be Relocated

A tract of about 550 acres of land near Gaithersburg, Md., has been selected for relocation of the Washington laboratories of the National Bureau of Standards. This move will permit the Bureau to replace research facilities which over the past fifty years have become inadequate for current needs.

Interferometer for Comparing Gage-Blocks to 0.0000001 Inch

An interferometric comparator that can make routine comparisons of length to the nearest ten-millionth of an inch has been developed at the National Bureau of Standards. This extremely precise instrument will be used to check the size of master gage-blocks for industry. A device of this accuracy has been greatly needed because of the extremely small dimensional tolerances now required in a number of industries.

At present, the Bureau calibrates master gage-blocks to one part in a million. Use of continually smaller tolerances, however, has caused machine tool manufacturers to request that procedures be developed to calibrate master gage-blocks on a routine basis to one part in ten million. Because of the extreme importance of this work, a government and industry sponsored research program toward this goal is now in progress.

The precise interferometric comparator represents an important step in this effort. A major problem still to be solved is the development of a means for absolute calibration of the Bureau's primary standard gage-blocks to the nearest ten-millionth of an inch. A study of gage-block materials is also being made under this program.

Like other interferometers, the new comparator determines the relative positions of surfaces by means of interference fringes formed by reflected light. However, in this instrument, greater accuracy is obtained by taking the readings directly from a micrometer screw instead of visually estimating the fringe displacements. Also, the measurement does not depend on the wave length of light used, since white light instead of monochromatic can be employed to produce the interference fringes. This greatly simplifies the measuring procedure, and operator training is minimized.

Spray Coating Protects Sheet During Forming

SHEET-METAL products can be protected from die marks and scratches during press operations by a new spray coating. Following fabrication, the coating is readily stripped from the surface. Use of the substance has the added advantage of extending the life of dies and rolls, because of its cushioning effect.

Tough and resilient, the coating is a synthetic resin, identified as EC-968 by its supplier, Minnesota Mining & Mfg. Co.'s Adhesives and Coatings Division, Detroit. The coating is shock absorbent and shows high resistance to abrasion and to deterioration by water, gasoline, or oil. It can be peeled off in large sheets by hand or

Fig. 1. A stainless-steel letter "O" for a sign is rolled to shape. After the sign is erected, the protective coating will be stripped off.

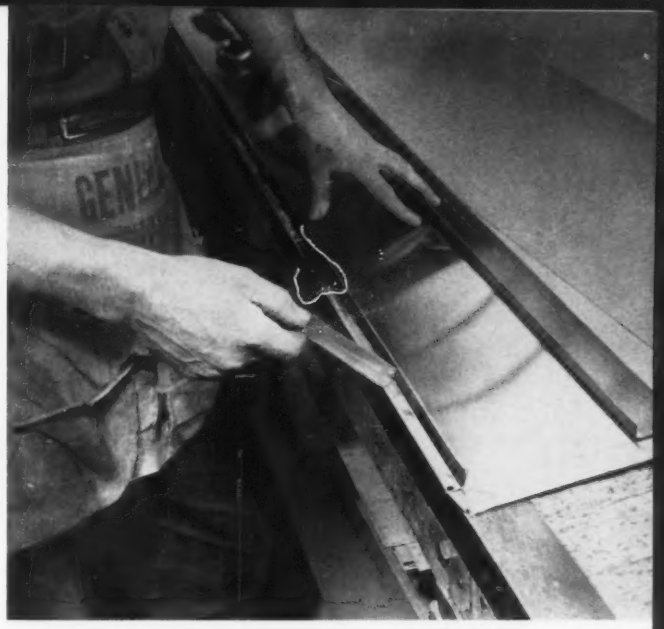


Fig. 2. Unmarred condition of the metal can be seen where a small section of the coating has been stripped off.

with an air jet. A properly applied film gives full protection, yet is easily removed, because its cohesive, or film, strength (ability to withstand self-rupture) is greater than its adhesive strength (ability to stick to a surface).

The protective coating can be applied to flat sheet or coil stock at the mill, or between manufacturing stages. It should not, however, be used on parts or sheets that are to be stored outdoors. Constant weathering and sunlight will cause the coating to increase in adhesiveness to the point where it can no longer be stripped from the metal.

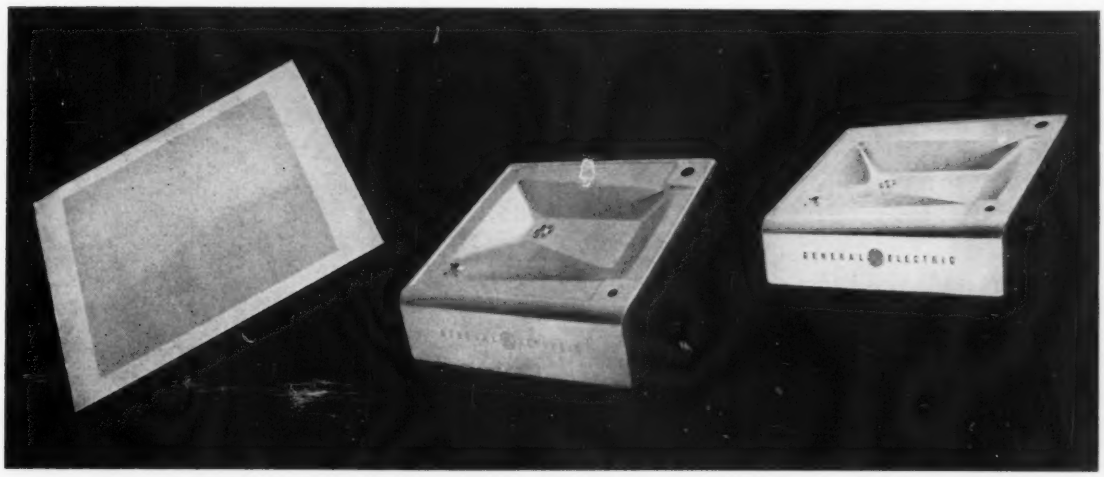
At the Hutchinson Sign Co., Trenton, N. J., EC-968 is sprayed on stainless-steel sheet before forming to odd and complex shapes such as letters or numbers. This activity is shown in the heading illustration. The coating remains on the metal through all handling, forming, drilling, cutting, and bending operations, and even during shipment and erection of the sign. A long section of coated stainless-steel sheet is shown in Fig. 1 being bent to form the letter "O." Good flexibility enables the coating to withstand cracking or buckling during bending.

Because of the intricate forming operations required in producing stainless-steel sheet-metal letters, it is necessary to strip a portion of the coating at a time. A small section is shown being removed in Fig. 2 to facilitate a hand-cutting operation which must take place before the work can be processed further. Heavy gougings and scrapings in the coating can be seen, yet the metal itself is unmarred.

In forming top plates for water coolers, L. F. Grammes & Sons, Inc., Allentown, Pa., spray-coats stainless-steel sheet to protect it from die marks. Before using the coating material, die marks appeared along sharp bends. A considerable amount of hand buffing was needed to remove all the marks.

The coating is sprayed on the sheet and air-dried for four hours. The sheet is then placed in a press and oiled thoroughly. Seven forming operations follow, the coating is stripped, and the work is polished chemically. In Fig. 3, the top plate is shown after spraying (left), after forming (center), and after stripping and finishing operations have been completed (right).

Fig. 3. The water-cooler top plate goes through seven forming operations, yet the coating is flexible and tough enough not to crack or buckle.



Wiping Out a Production Problem

By Hans W. Preuss, Industrial Engineer
Voicewriter Division
Thomas A. Edison, Inc.
West Orange, N. J.

ONE of the biggest problems encountered in manufacturing the Voicewriter office dictating machine is cleanliness. Many parts of this instrument are so delicate that they must be handled with tweezers; other parts are machined to very close limits of accuracy and surface finish. Because of the nature of the work, it is essential that no lint, oil, or metal filings be allowed to enter into the assembled mechanism.

With this in mind, the rags usually found in the plant have been replaced by disposable paper wipers developed by the Scott Paper Co., Chester, Pa. These wipers are virtually lint-free and, being used but once, eliminate the possibility of transferring unwanted particles from one job to another.

Some phases of the assembly work required on the dictating machine are performed in a special temperature- and humidity-controlled room. Personnel must wear lint-free smocks to help reduce the possibility of circulating dust particles in the air. Under such circumstances the paper wipers have proved indispensable in maintaining component cleanliness during assembly, Fig. 1, as a small bit of fuzz settled in the mechanism could result in rejection of the entire unit.

Delicate assembly is not the only application for the wipers. They are being used to equal advantage in the shop for cleaning machines, tools, and parts. The bolster plate of a punch press is shown being cleaned in Fig. 2 prior to being set up for a new run of stampings. Other areas of use are in the plating room, paint shop, and silk screening department. In the plating room, the

Fig. 1. In a temperature- and humidity-controlled room, final inspection is made on sub-assemblies for an office dictating machine. All of the components must be absolutely lint-free.

Fig. 2. Cleaning the bolster plate of a punch press before setting up new tooling. These embossed, disposable paper wipers are being used extensively in a great many similar applications.

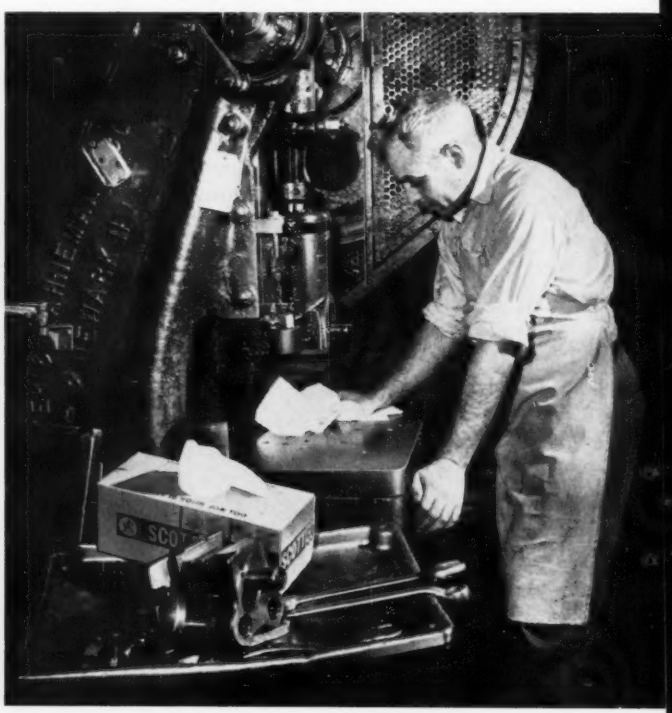


Fig. 3. Working first with machines, cutting oils, and chips—and then with blueprints—calls for quick, safe hand wiping before tackling the paper work.

wet strength of the wipers is especially important as the steam from the cleaning baths causes a great deal of perspiration.

Tiny metal chips that become lodged in wiping rags can in addition to damaging machinery and delicate work-pieces, cause injury to the workers using them on hands and face, Fig. 3. Thus the safety of disposable paper wipers is not overlooked.

* * *

Applying Aluminum Oxide to Metals

A thin protective coating of aluminum oxide can now be applied to all common engineering metals except chrome and nickel plate. During the process, known as Flame-Plating, the temperature of the metal being coated does not exceed 400 degrees F. This allows all the metallurgical characteristics of the base metal to be retained.

The aluminum-oxide coating is abrasion, chemical, and high-temperature resistant. It also has a porosity of less than 1 per cent. Coated surfaces can be ground and lapped to a 1-micro-inch finish. The finish in the as-coated condition is in the 125- to 150-micro-inches range.

In Flame-Plating, developed by the Linde Air Products Company, a division of Union Carbide & Carbon Corporation, New York City, particles of the coating material that are suspended in an explosive gas become molten and are blasted onto the surface of a work-piece when detonated with a specially constructed gun. The particles build up on the work-piece and fuse together until the desired thickness is obtained. While the bond to aluminum is exceptionally strong, the adhesion to other metals is more than adequate.

Progress Through Measurement Seen in Traveling Exhibit

The effect of precise measurement on modern living standards is forcefully demonstrated in a new traveling exhibit, "The Story of Measurement." Prepared for the DoALL Co. by the Wilkie Foundation of Des Plaines, Ill., in cooperation with leading museums and universities, this exhibit is the second in a series created to portray the improvement of man's material welfare through the use of tools. By the graphic use of three-dimensional display panels and large, full-color screen slides, "The Story of Measurement" dramatically portrays the development of measurement standards, techniques, and instruments used to control the quality of work done by material shaping tools.

Typical of the many standards shown on the panels is an exact replica of man's first measurement standard, the Egyptian cubit stick, dating back 5000 years. This first recorded standard of linear measure was based on parts of the human body—the "Royal Cubit" having been decreed by an Egyptian Pharaoh as the length of his forearm. Wooden "working cubits" were checked against a black granite "master cubit" each month to assure a uniform standard of size.

Visitors are encouraged to handle the latest precision measuring tools used for quality control. These include electrical and mechanical comparators capable of detecting deviations as small as one millionth of an inch. Also shown is the use of optical flats, with monochromatic light generators, to show interference bands of light by which minute variations in flatness, size, and finish can be interpreted into linear measurement.

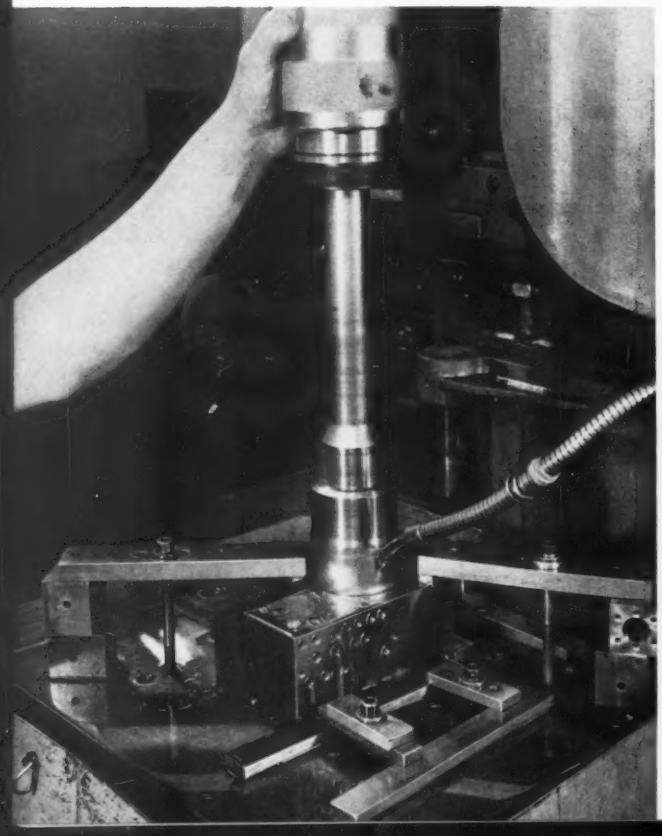
The exhibit is currently touring the northeastern states, and, during the 1957-58 season, will be in the Southeast. Information regarding further details and bookings may be obtained by writing The DoALL Co., Gage Division 254 N. Laurel Ave., Des Plaines, Ill.

Controlled Facilitates the Hydraulic

Valve-stem of an air-gage tracer is ground in the finish-machining area. Hydraulic headstocks and tracer systems are assembled beyond the glass partition.

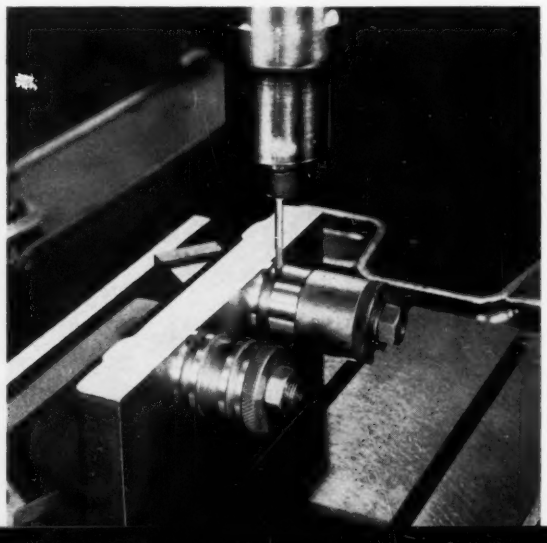
PARTS for hydraulic lathe headstocks and air-gage tracer systems are now being finish-machined, assembled, and tested in a carefully regulated atmosphere at the Monarch Machine Tool Co., Sidney, Ohio. Close-tolerance machining, grinding, and honing are confined to one glass-enclosed room in the newly expanded hydraulics department, while another room is set aside for final assembly and testing of completed units. Temperature and humidity are both closely controlled in these areas. The facilities were built to increase production and, at the same time, maintain the accuracy required.

Assembly operations are handled on a straight-line production basis. One feature of this arrangement is the positioning of specially designed test fixtures at strategic points. Headstocks are tested on shortened versions of the beds used on regular production lathes. After each headstock has passed operating tests, it is sent as a unit to the final-assembly department. Tracer units are handled in a similar manner.

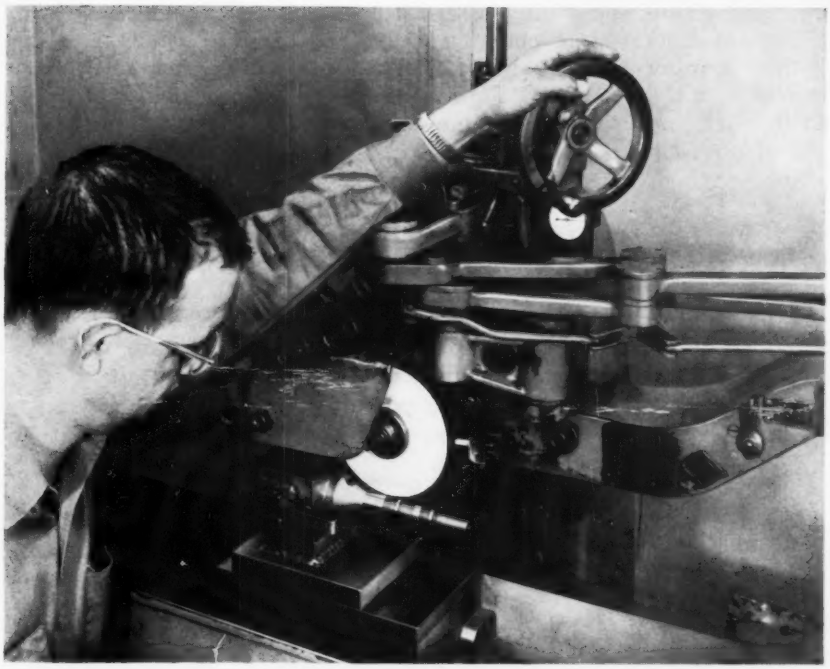


(Left) The 3-inch diameter bore of a headstock valve selector body is honed in one section of the newly enlarged facilities.

(Below) A 3/16-inch diameter hole is accurately ground in a headstock valve sleeve on a Moore jig borer equipped with a Vulcan air head.



Environment Production of Components



(Above) Following honing, a tracer valve is checked with a Sheffield Precisionaire gage. Taper, roundness, straightness, and size are held to within 0.0001 inch.

(Left) Form-grinding a porting vee in a lathe headstock valve-stem is handled on a surface grinding machine equipped with a Panto-Crush dressing attachment.

(Right) Assembled air-gage tracer power unit, at right behind operator, is checked with this special test rig. Indicator in place of cutting tool on tracer-slide must follow master within 0.0001 inch.

How Work Runout Varies with Center Errors

By Richard L. Thoen
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General Mills, Inc.
Minneapolis, Minn.

In general, runout measurements are not duplicated on different sets of mounting centers. The observed runout changes from one set of mounting centers to another. In many cases, this deviation is small compared with the runout tolerance for the part and thus is of no concern. However, in certain types of precision manufacture it is not uncommon for the runout variation from mounting center to mounting center to exceed the runout tolerance. Examples of this situation are parts that will run true while in the machine but yet show excessive runout when on a set of inspection centers. The causes of runout variation and the ways of preventing its occurrence are dealt with in this article.

Basically, if the axes of the two center cones in the part are not coincident, part runout will be sensitive to any geometric difference between sets of mounting centers. Special cases having this characteristic are shown in the two-dimensional diagrams, Figs. 1 through 4. The problem is actually three dimensional as the cone axes need not intersect, but for purposes of general discussion a simplified two-dimensional explanation is adequate.

An arbor that happens to run true on a particular set of centers is shown in Fig. 1. The included angles of all four cones are equal, the axes of the mounting center cones are coincident, the two part center diameters are equal, and the axes of the part center cones intersect at a point external to the arbor. This point of intersection could lie

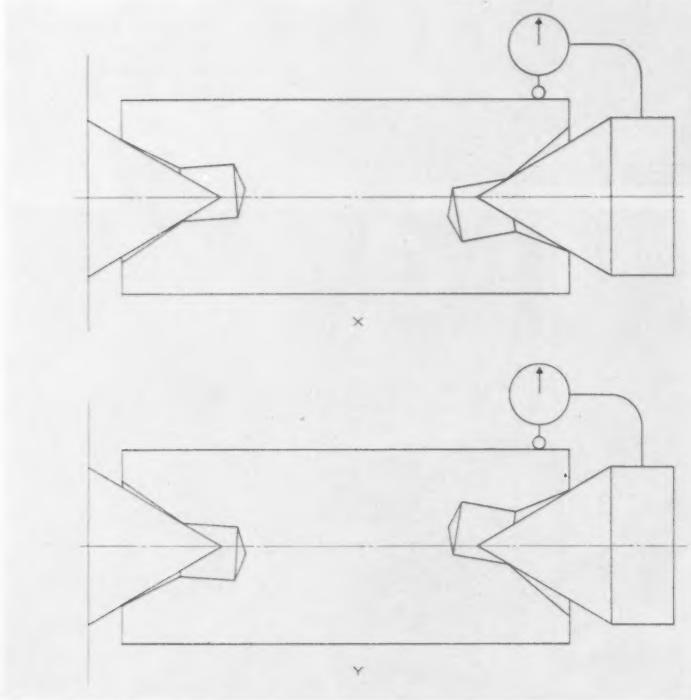


Fig. 1. Arbor that happens to run true on a particular set of centers. View Y shows the arbor after going through a rotation of 180 degrees.

anywhere inside or outside the arbor, but runout variations will be somewhat greater with the condition shown.

The same arbor is mounted on a different set of centers in Fig. 2. All conditions are the same as for Fig. 1, except that the included angles of the mounting center cones do not equal those of the part center cones. As a result, the arbor does not run true. In order to compute the magnitude of the runout, it is necessary to assume a point at which the axes of the part center cones intersect. The derivation of the runout formula, Equation 1, is too lengthy to be given here. However, assuming the axes of the part center cones intersect at a point ten arbor lengths to the right of the right center, the magnitude of the runout at the point shown is

$$R = \left(5 \frac{D+d}{\cos^2 A} B + \frac{D-d}{\sin 2A} \right) | \triangle A | \qquad (1)$$

where

$| \triangle A | \leq 10 \times B$; and
R = total runout, inches;
D = major diameter of part centers, inches;
d = minor diameter of part centers, inches;
B = relative skewness between axes of part center cones, inches per inch;
A = nominal half angle of all cones, degrees;
$\triangle A$ = error in half angle of mounting cones, inches per inch.

Example 1. Let $D = 0.110$ inch, $d = 0.047$ inch, $A = 30$ degrees, and $\triangle A = 0.0040$ inch per inch. Also, assume that the axes of the left and right part center cones are skewed with respect to the longitudinal axis of the arbor by 0.00015 inch and 0.00025 inch, respectively, in the distance between their outer and inner rims.

The distance between the outer and inner rims is equal to $(D-d)/(2 \tan A)$, or 0.055 inch. Thus, the relative skewness of one part center cone to the other is $B = (0.00015 + 0.00025)/0.055$, or 0.0073 inch per inch.

Then, from Equation 1,

$$R = \left(5 \frac{0.110 + 0.047}{0.75} 0.0073 + \frac{0.110 - 0.047}{0.866} \right) 0.0040$$
$$= 0.00032 \text{ inch}$$

The runout on the left side of the arbor, shown in Fig. 2, would not increase appreciably if the mounting center cone angle were increased, since the contact would be solely on the outer rim of the part center. However, Equation 1 is limited to the range in which contact with the mounting centers occurs on both outer and inner rims of the part centers. This is the reason for the limiting condition $| \triangle A | \leq 10 \times B$.

In Fig. 3, the same arbor is shown mounted on a set of centers under the same conditions as specified for Fig. 1, except that the axes of the mounting center cones intersect at a point out-

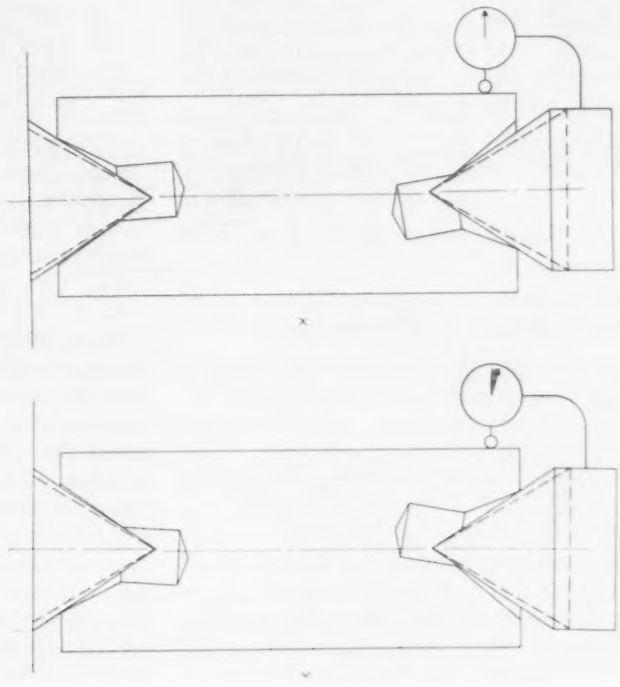


Fig. 2. These centers have a cone angle greater than nominal. Arbor is the same as shown in Fig. 1, and nominal cone is shown in broken lines.

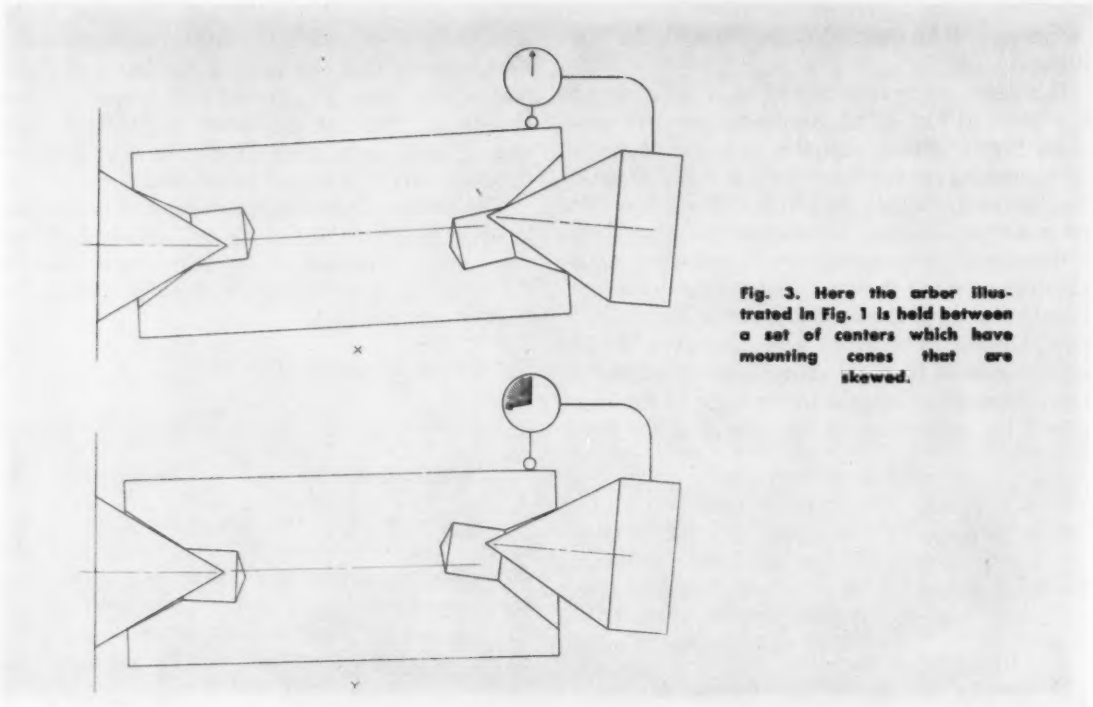


Fig. 3. Here the arbor illustrated in Fig. 1 is held between a set of centers which have mounting cones that are skewed.

side of the right center. Except for one point of rotation, the arbor location is ambiguous; that is, it does not make positive contact with the mounting centers. (This is one reason for the nonuniform rotational drag that often occurs in practice.) However, for purposes of discussion, assume that the arbor is pressed downward and to the left and that the axes of the mounting center cones intersect at a point ten arbor lengths beyond the right center. For these conditions the runout at the point shown is

$$R = \left(100\,\frac{D+d}{\text{Cos}^2\,A}\,B + \frac{D-d}{\sin 2A}\right)S \qquad (2)$$

where

$S \leq B$; R, D, d, B, and A are the same as in Equation 1 and

S = relative skewness between the axes of the mounting cones, inches per inch.

Example 2. Let D, d, A, and B be the same as in Example 1 and $S = 0.0020$ inch per inch. Then,

$$R = \left(100\,\frac{0.110+0.047}{0.75}\,0.0073 + \frac{0.110-0.047}{0.866}\right)0.0020$$

$$= 0.00045 \text{ inch}$$

The same arbor is mounted on a third set of centers in Fig. 4. Here, all conditions are the same as for Fig. 1, except that the axes of the mounting center cones are offset. As in Fig. 3, the arbor location is ambiguous. For the same downward and left position of the arbor assumed, the runout at the point shown is

$$R = 10\,\frac{D+d}{L\cos^2 A}\,B\,P \qquad (3)$$

where

$P \leq 10 \times L \times B$; R, D, d, B, and A are the same as in Equation 1 and

L = arbor length, inches;

P = separation between axes of mounting center cones, inches.

Example 3. Let D, d, A, and B be the same as in Example 1, $L = 1.0$ inch and $P = 0.005$ inch. Then,

$$R = 10 \times \frac{0.110+0.047}{1.0 \times 0.75} \times 0.0073 \times 0.005$$

$$= 0.00008 \text{ inch}$$

These illustrations and equations demonstrate certain characteristics of machine centers. In the practical sense, any such analysis, whether it be two or three dimensional, will be qualitative in nature because the part center errors are usually unknown. That is, the form of the part center cones and the relative position of one to the other are difficult to measure.

In practice, perhaps the safest procedure to follow is that of measuring part runout on two extreme sets of mounting centers. The difference between each set is such as to simulate the largest possible difference that would be encountered be-

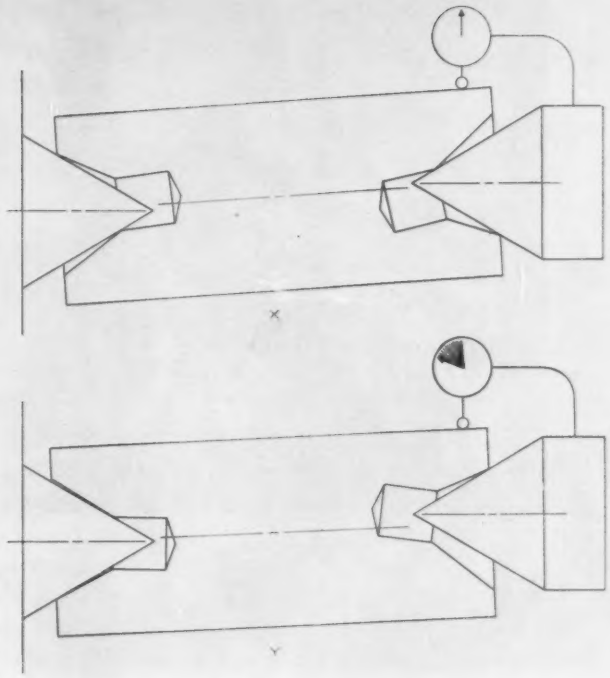


Fig. 4. A set of mounting cones having center lines that are parallel but displaced. Again, the arbor is the one which is illustrated in Fig. 1.

tween any other sets of mounting centers. That is, one set is substantially perfect except for a maximum cone angle error (Fig. 2). The second set of centers contains all the maximum allowable deviations from nominal. The cone angle error illustrated in Fig. 2 is opposite in direction, and the skewness (Fig. 3) is superimposed upon the parallel displacement indicated by Fig. 4. Then, if the runout variation of a particular part were sufficiently small, as noted on these two extreme sets of mounting centers, it could be assumed that the part runout would not be appreciably different when mounted on other sets of centers.

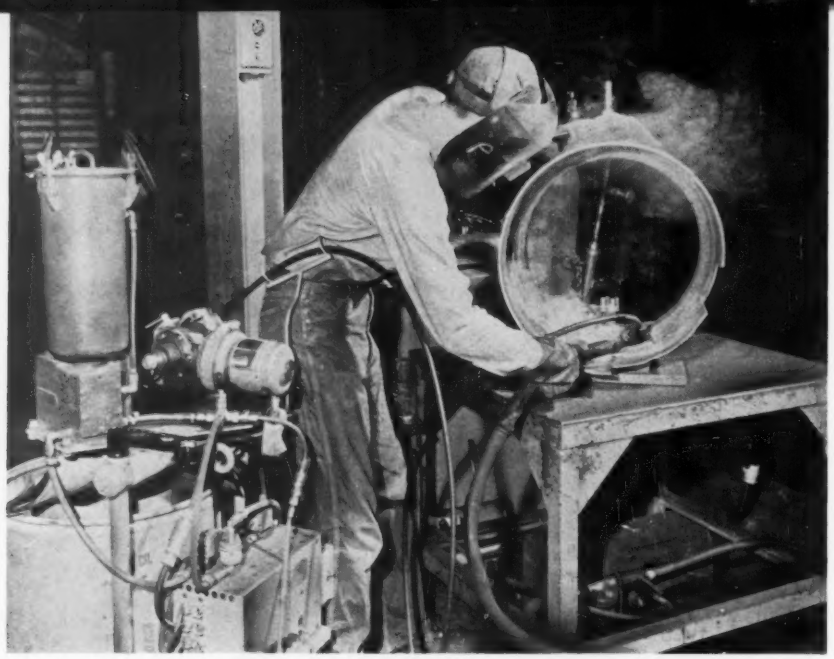
A simple functional check on the accuracy of mounting centers can be obtained with special arbors. These are made representative of typical parts insofar as arbor lengths and center diameters are concerned. Skewness between the axes of the arbor center cones is made relatively large, and the runout of each arbor on two extreme sets of mounting centers is noted. These two observed values of runout for each arbor will serve as limits that are not to be exceeded when the arbors are used to test other sets of mounting centers. The method of making these special arbors is quite simple and inexpensive. The tailstock of a center-lapping machine is offset to give about 1 degree of skewness between the arbor and spindle axes. One of the arbor centers is then lapped to produce a runout of about 0.0004 to 0.0008 inch. The other arbor center is left untouched.

To prevent excessive runout variations between different sets of mounting centers (if large errors in part centers are permitted), it is necessary to provide relatively accurate mounting centers. Conversely, small errors in part centers will permit the use of relatively inaccurate mounting centers. The cost of holding a given level of quality in the manufacture of part centers should be weighed against the cost of maintaining a certain order of accuracy in all of the sets of mounting centers that the parts may contact. In this respect, Equations 1, 2, and 3 are useful inasmuch as they tend to indicate the effect of certain types of refinement.

* * *

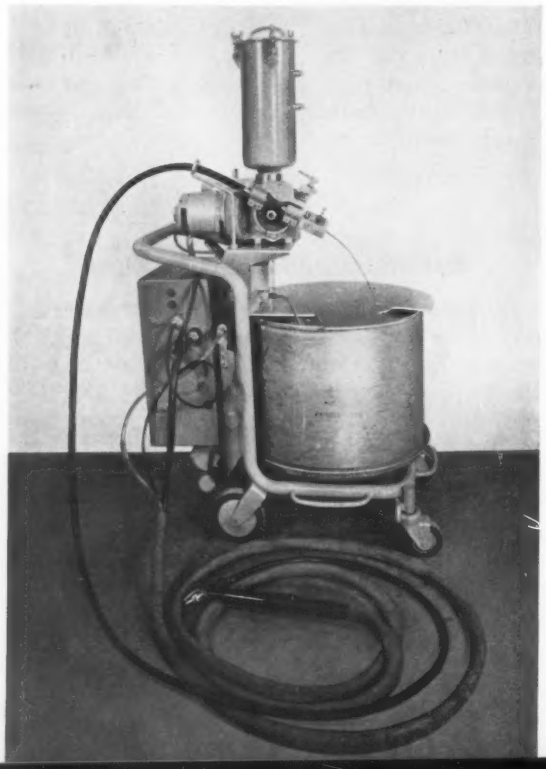
Zirconium for Atomic Reactors

Zirconium—until recently little known—is now one of the most newsworthy metals. In 1956, the Atomic Energy Commission issued contracts to three companies for the purchase of 11,000,000 pounds of zirconium over a five-year period, for a total of about $75,000,000. The bulk of the contracted metal will be used for Navy and AEC atomic reactor development programs. Zirconium is suitable for use as a protective coating or "cladding" for uranium in solid fuel elements, and as a construction material for water-cooled (aqueous) nuclear reactors.



Magnetic Flux Combines with Carbon Dioxide to Shield Arc

CONTINUOUSLY fed electrode wire that is magnetically coated with flux and shielded in an inert-gas atmosphere is the basis of a new Unionarc welding method. Developed by the Linde Air Products Company, Division of Union Carbide and Carbon Corporation, New York City, this welding unit, Fig. 1, consists of four basic units—an air-cooled, manual welding torch; a powder dispenser assembly; a welding control; and the basic mechanical assembly.



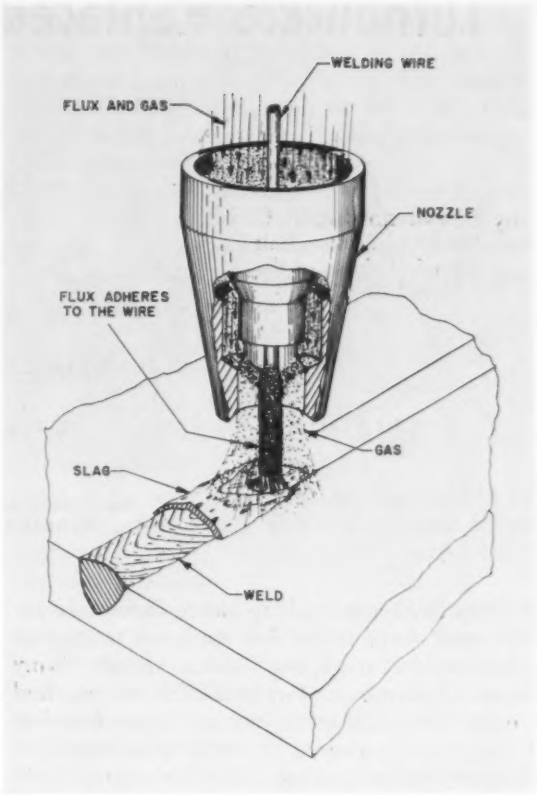
Bare steel electrode wire, preferably 3/32- or 3/64-inch diameter, passes from a 300-pound capacity pack, past feed-rolls, through a flexible conduit and into the torch. The pack is supported, and rotated, on a motor-driven turntable controlled so that wire tension at the feed-rolls is minimized. Under average welding conditions, the pack should provide at least one week's supply of wire.

Specially compounded, magnetizable flux is contained in a dispenser, or hopper. During normal operation, the hopper is pressurized at 4 pounds per square inch. It can be adjusted to feed from 3/8 to 1/2 pound of flux per pound of wire consumed. This predetermined ratio is automatically maintained regardless of the rate of wire feed.

After flowing from the hopper, the flux is entrained in a stream of carbon dioxide gas (supplied from commercial containers) and is carried to the torch through a powder hose assembly.

Fig. 1. Semi-automatic welding machine feeds bare electrode wire, powdered magnetic flux, and carbon dioxide gas to the torch.

Fig. 2. As the bare electrode wire leaves the torch nozzle, the flux is attracted magnetically to it, giving the effect of a coated electrode.



The powder-gas stream is directed through a grooved insulator in the torch body to four orifices in the nozzle. At the nozzle, the magnetic field created by the heavy current flow through the electrode attracts the flux to the wire. This causes the wire to be coated as it is fed into the arc, as illustrated in Fig. 2. The insulator also isolates the effect of the magnetic field around the wire so that the flux is attracted only to the wire in use and not to other torch parts along the flow path.

As the wire is directed into the weld puddle, the flux melts, refining the weld metal and shielding it from atmospheric contamination. Carbon dioxide flowing from the torch nozzle assists in shielding the molten metal and the arc. This open-arc characteristic of the process permits unobstructed visibility of the weld zone by the operator at all times.

Welds in carbon steel develop an ultimate tensile strength of 75,000 to 85,000 pounds per square inch, and a yield strength of 65,000 to 70,000 pounds per square inch. Constituents of the flux lower the surface tension of the weld puddle, improving weld surface contour. The thin skin of the fused flux and slag comes off easily—frequently of its own accord, as can be seen in Fig. 3. With this equipment, it is claimed that weld metal can be deposited at a rate 50 to 100 per cent greater than that obtained with coated electrodes on most common downhand applications. In vertical and overhead positions, the deposition rate is said to be two to three times that realized with coated electrodes.

Direct current with a reverse polarity hookup is preferred. A current flow ranging between 350 and 450 amperes is recommended when using 3/32-inch diameter electrode wire—125 to 250 amperes when using 3/64-inch diameter electrode wire. Use of constant-potential direct current is preferred, although a conventional power supply can also be used.

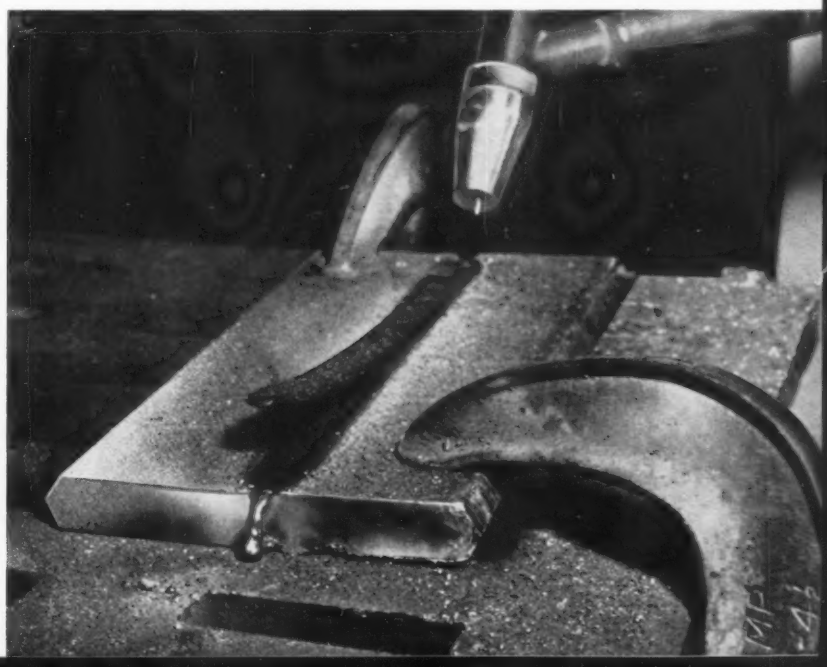


Fig. 3. As the weld cools, the slag rises cleanly from it. Characteristics of this welding process have greatly reduced post-weld cleaning time.

Turnbuckle Replaced by Crimped Tubing

By BERNHARD ROGGE, Chief
Design Evaluation Unit
Chemical Corps of the
United States Army

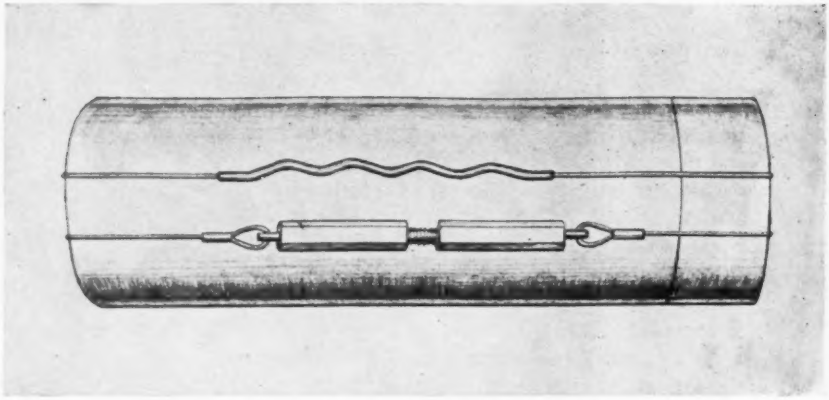


Fig. 1. Crimped metal tubing (top) has replaced the conventional turnbuckle (bottom) for retaining a steel wrapping cable under a fixed tension.

CRIMPED metal tubing has replaced conventional turnbuckles for applying tension to stranded-steel wrapping cables at the Army Chemical Center in Maryland. The new method is used to retain a metal cap on the open end of a long metal cylinder under a predetermined pressure. For comparison, both the crimped tubing and the turnbuckle are illustrated in Fig. 1. In the original design, friction caused by long thread engagement of the turnbuckle and variation in part size made determination of proper tension in the wire cable difficult. Use of the special tube-crimping device shown in Fig. 2 speeded mass assembly of the units and proved less costly.

The turnbuckle, consisting of several parts, has been replaced by a short piece of metal tubing *A* that is slipped onto a length of stranded-steel cable *B*. After assembling the cable into a closed loop, it is wrapped around the cylindrical body *C* and cap *D*. The assembly is then placed in clamping cradle *E* of the tube-crimping machine. A pneumatically operated clamp *F* holds the cap tightly on the cylinder while it is in the cradle.

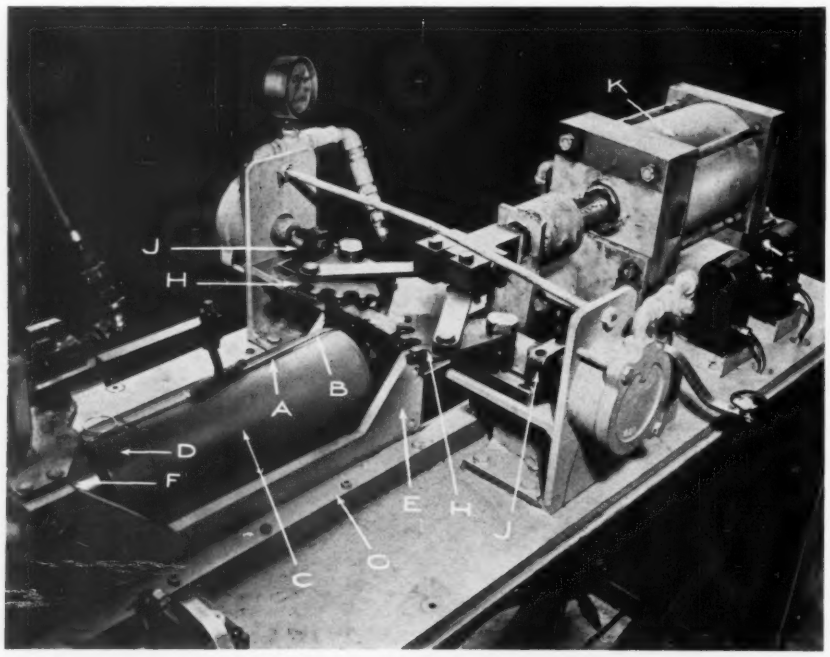


Fig. 2. Close-up view of the tube-crimping machine showing the assembly to be secured, the wrapping cable, and the length of tubing resting in the work cradle prior to crimping.

A second pneumatically operated unit (not shown), mounted under the machine table, moves the cradle and assembly along guide rails *G* to the center of the machine.

At this point, the crimping fingers *H* engage the tube and crimp it progressively from the right-hand end. The crimping fingers, mounted on two air-cylinder-controlled slides *J*, are able to produce a fixed tension in the wrapping cable by gradually separating to reduce the depth of crimping. This is accomplished by balancing the pressure in the two air cylinders controlling the slides against the force required by the crimping fingers to produce the proper tension in the cable. When this balanced condition is reached, the fingers are separated so that no further crimping takes place. The rotating movement of the crimping segments is effected by links connected to a fifth air-operated cylinder *K*.

Hand-operated air valves at the front of the machine table initiate the clamping and crimping actions. After crimping, the assembly is released and automatically returned to its original position for unloading.

Welded Pedestals on New Turret Lathe Line

Pedestals on six models of the new Warner & Swasey turret lathe line are steel weldments. Each machine requires two pedestals—one under the head end, and the other, under the foot end. A fabricated chip pan rests on the pedestals, and the integral head and bed casting, in turn, is located on the chip pan.

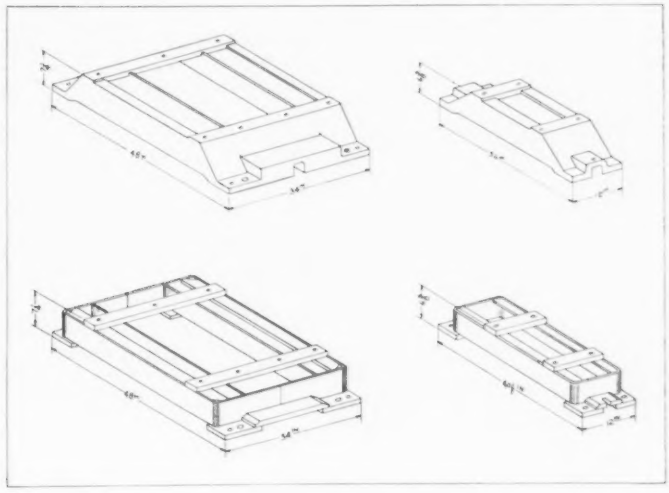
After the initial lot of the new turret lathes had been built, it was decided that because of frequent abuses in shipment, the pedestals (made of cast-iron) might well be redesigned for greater strength by increasing wall thickness and adding more internal ribs. Further, because the lag bolts and adjusting screws on the foot pedestal were beneath the pan, making access difficult, it appeared advisable to bring them out about 4 1/2 inches. This would have meant a 15 to 20 per cent increase in casting cost, exclusive of needed pattern changes, and added machining.

At this point, it was decided to make the pedestals by forming and welding standard steel shapes. In the steel design, the pedestals proved stronger, even with wall thickness reduced to 1/2 inch. Better resistance to the shock and impact loads encountered in shipping the turret lathes was also obtained.

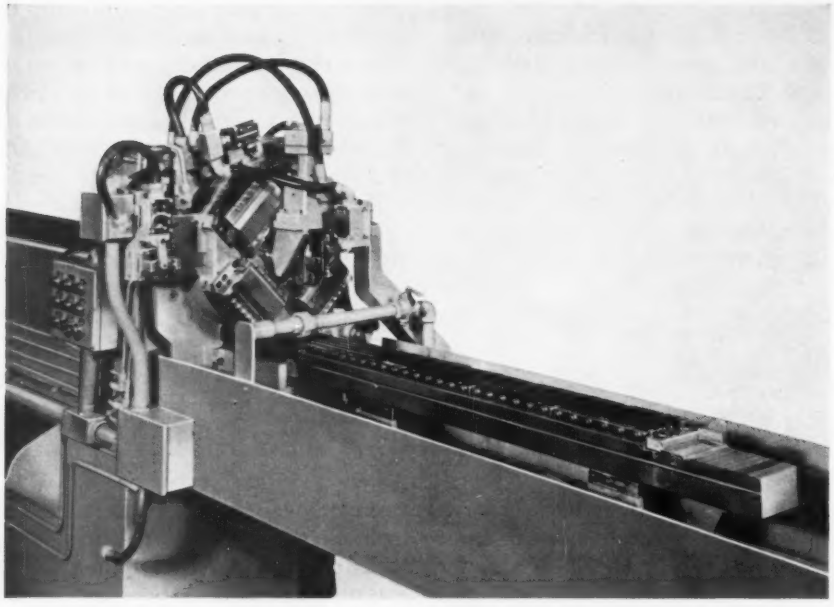
Dollars and cents savings came to approximately 60 per cent. Cost of the head-end pedestal dropped from $95 to $31 when fabricated instead of cast. Likewise, the cost of the foot-end pedestal dropped from $40 to $24. In the accompanying illustration are drawings of the cast pedestals (upper views) and fabricated pedestals (lower views).

• • •

Under its Employe Suggestion Plan, General Motors, in the period from April 1942 through September 1955, paid its employes $16,578,277 for 352,316 adopted suggestions for improving safety and working conditions, saving material, and making jobs easier. Employes submitted 1,483,179 suggestions during this period.



These drawings show the old cast-iron head and foot pedestals (upper views) and their redesigned fabricated - steel counterparts (lower views).



Broaching Machine with Eight-Position Indexing Fixture

BRASS lock cylinders are being broached at the rate of 1250 per minute by a manufacturer using an eight-position rotary fixture that features automatic clamping and unloading. The work-indexing unit is employed on a 10-ton, 60-inch, universal horizontal broaching machine. Both the machine and the fixture were designed and built by the Colonial Broach & Machine Co., Detroit, Mich.

The operation is continuous, with the indexing unit having four work-holders, each designed to handle five lock cylinders. A battery of five parallel broaches are used to cut the parts after each holder has been indexed into the bottom or broaching station. Prior to the return stroke, the fixture is advanced half of the distance to the next work-holder. The machine is shown at one of these four broach return positions in Fig. 1.

Lock cylinder blanks are loaded manually but are clamped and ejected automatically. The broaching speed is 30 feet per minute, and the return speed is 100 feet per minute. A typical lock cylinder is shown in Fig. 2. Part length and diameter can be varied with only minor changes in tooling. Alignment of the keyslot is held to within 0.001 inch to insure easy lock operation.

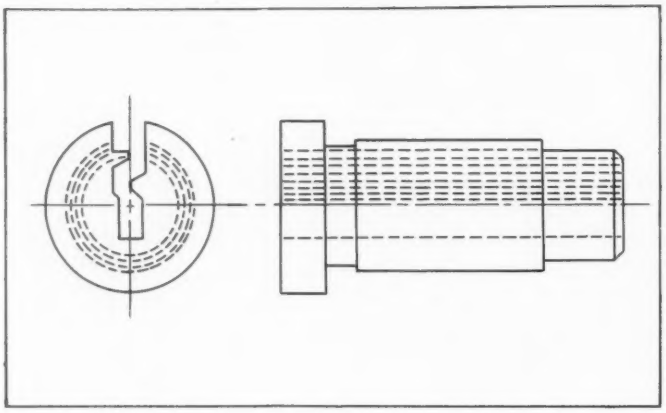


Fig. 1. (Above) Fixture that indexes work-holders for broaching lock cylinders is shown in a broach return position.

Fig. 2. (Left) Five lock cylinders, such as the one here shown, are broached in one cutting stroke of the machine illustrated in Fig. 1.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Investment-Casting Alloy for High-Temperature Applications

This high-temperature alloy, designed for investment-cast turbine wheels, buckets, and vanes, for use at temperatures in excess of 1400 degrees F. has been announced by Haynes Stellite Co., Division of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. The alloy, called GMR-235, has good room-temperature ductility, a very low strategic alloy content, and exhibits a marked resistance to overaging at service temperatures for periods over 1000 hours.

It is produced both by air-melting and vacuum-melting techniques. The air-melted version is produced to a minimum of 75 hours at 35,000 pounds per square inch stress-to-rupture at 1500 degrees F., with a minimum elongation at rupture of 5 per cent. Vacuum-melted, it is capable of meeting a minimum of 60 hours at 28,000 pounds per square inch stress-to-rupture at 1600 degrees F., with a minimum elongation at rupture of 10 per cent.

Nickel-Plated Steel Wire Made Available for Commercial Use

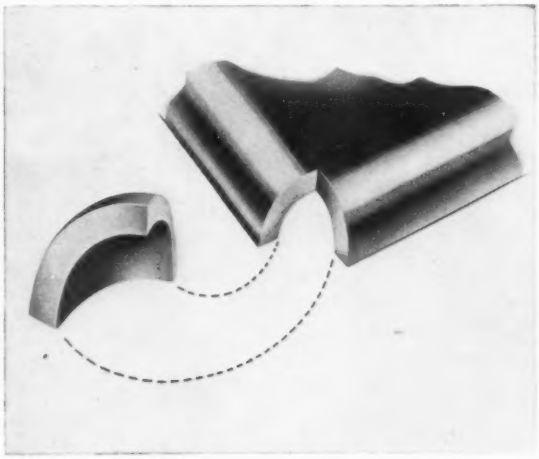
The commercial availability of "Fernicklon," a nickel-plated steel wire with up to a 10 per cent nickel coat, has been announced by National-Standard Co., Niles, Mich. The material has been developed for use wherever combinations of strength, corrosion resistance, and lustrous finish are desirable. The base metal is either a high-carbon, low-carbon, or alloy steel (copper alloy base metals are also available). A uniform coat is deposited directly on rod or wire, and the material is drawn by conventional methods to finished size. Narrow coating tolerances are maintained even in thin coatings.

Commercial sizes of Fernicklon are supplied in a range of from 0.010 inch to 0.310 inch, depending on tensile strength in either matte or super-bright finish. The super-bright finish rarely requires further finishing. After drawing, the wire can be annealed, shaped, or worked without chipping or flaking of the coating. Operations such as bending, flattening, swaging, and even thread-rolling can be performed. If certain precautions are observed, it can be spot- or butt-welded.

Applications include automobile radio antennas, indoor television antennas, lamp frame wire, processing baskets, wire conveyor belting, and closely coiled helical springs.

Spherical Corners Facilitate Design of Weldments

Spherical corners which can be furnished in metal thicknesses ranging from 1/8 inch to 1/2 inch, and in outside radii from 1 1/8 inch to 3 inches—depending upon thickness—have been announced by Conner Steel Products, 24690 Telegraph Road, Detroit 19, Mich. Known as "Conner Spherical Corners," they can easily be welded into place on weldments having round edges, such as machine tables, housings, drip pans, and panels. Use of these corners makes possible design of products with smooth, flowing lines. The accompanying photograph shows a possible use for one of these corners.



Spherical corners of this type can be obtained in various thicknesses and radii for welding to parts.

Low-Cost Impregnating System Insures Pressure-Tightness of Castings

An impregnating process whose components occupy a floor area of approximately 8 by 11 feet has been announced by the American Metaseal Mfg. Corporation, West New York, N. J. The unit —Model 1-24-L impregnating system—includes an impregnating tank, cleaning and rinse tanks, reservoir, vacuum pump, vapor trap, valves, gages, and pipes. This system was developed to correct leakage and internal corrosion caused by microscopic porosity in cast-metal parts. The Metaseal impregnant is based on a polyester type resin which "sets" to form a solid structure. The impregnant has good wetting properties, assuring good pore penetration.

Castings are batch immersed and then subjected to pressures which force the impregnant through all casting pores. After a wash in a special cleaner, the castings are placed in ovens for curing.

According to the manufacturer, where cast metal parts are required to contain a liquid or a gas, it is simpler and less expensive to impregnate all parts than to test every part for leaks, impregnate those that leak, and then test again.

Super-Soft Rubber Absorbs Vibration and Dampens Noise

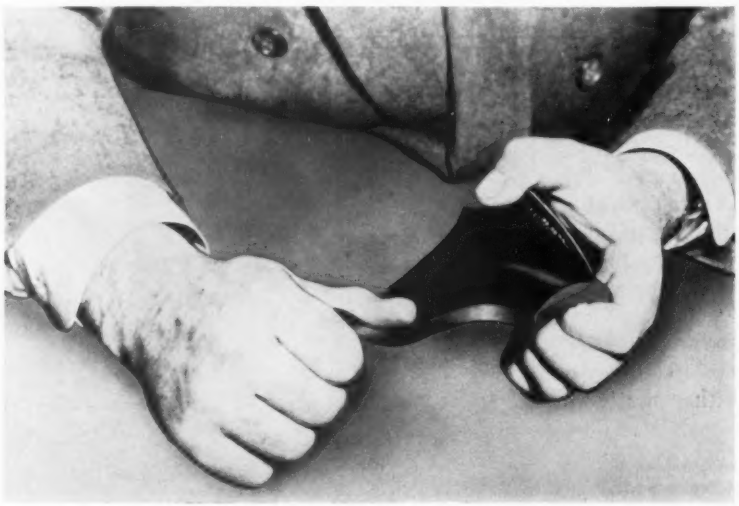
A non-porous, super-soft rubber that can be easily bonded to metal has been announced by the Roth Rubber Co., 1860 South 54th Ave., Chicago 50, Ill. Called compound RRD-992, it is said to be the softest solid rubber developed by the industry—it has a softness characteristic of 5 durometer—and can be used in temperatures up to 200 degrees F. It is a reasonably good electrical insulator and can be vulcanized or bonded to metal and other materials. The company makes this super-soft rubber in sheets or strips up to 1 inch thick, and will mold or bond it to metal or other odd shapes as a customer service. Indicated uses include: vibration and shock absorption, noise dampening, air-tight and water-tight sealing, electrical insulation, and many other applications requiring a super-soft material.

Teflon Fibers for Facing Bearing Surfaces

The use of woven "Teflon" tetrafluoroethylene fiber—a very slippery material—in bearings has been announced by E. I. duPont de Nemours & Co. (Inc.), Wilmington 98, Del. As a facing material on the wear surfaces of automotive suspension joints, it reduces the amount of friction by more than 50 per cent in comparison with standard lubricated suspension joints. In addition, it functions without customary lubrication.

Use of the fiber in a ball and socket suspension joint is achieved by double weaving it with a backing of nylon or cotton. The fabric is then laminated with cotton-reinforced phenolic resin and formed into a cup which lines the socket. Metal parts are coated with a special grease to prevent corrosion. The joint is assembled, and the preforming bearing is molded into place, assuring a perfect spherical contact between the ball stud and the bearing. The joint is then sealed.

Other uses for the fiber include: spherical parts such as rod ends and ball-socket joints for special controls and self-aligning bearings; cylindrical parts such as seals, bushings, pistons, and sleeve bearings for all types of machinery, marine propeller shaft bearings, and steel roller mill bearings; and flat or sliding parts, such as leaf-spring end pads and slider beds for adjustable seats and conveyor belts.



Super-soft rubber, RRD-992, that absorbs vibration, dampens noise, and may be used in applications requiring a sponge material.

Cemented Tungsten Carbide for Hard-Facing or Cutting

A cemented tungsten-carbide product which can be used either as a hard-facing material or as a cutting material has been announced by Kennametal Inc., Latrobe, Pa. When produced in small particles this product, known as "Kenface," can be welded to steel bodies for cutting hard rock. The material may also be produced in shapes that will avoid engaging and tearing, in which case it is used for hard-facing applications such as power shovel teeth, road scraper blades, and numerous other wear-proofing purposes.

Aluminum-Oxide Abrasive that Holds its Form and Remains Sharp

An economical abrasive which has great toughness, a high inherent strength, a fine crystal structure, and holds its sharpness has been announced by the Norton Co., Worcester 6, Mass. Known as 44 Alundum, this material, used in the form of grinding wheels, holds its form, grinds many workpieces per dressing, gives a good finish, and performs a fast cut with little heat. This abrasive is well suited for applications such as ball-bearing grinding; honing; centerless, cylindrical and internal precision grinding; saw gumming; snagging; and thread grinding.

Structural Magnesium-Thorium Alloy Withstands Intense Heat

A magnesium-thorium alloy that combines light weight and strength with the ability to withstand the intense heat generated by friction at supersonic speeds has been announced by the Dow Chemical Co., Midland, Mich. Called HM21XA-T8, this sheet and plate alloy is available in production quantities for high-temperature aircraft and missile applications.

It can be used in a temperature range up to 700 degrees F. At this level, the alloy will withstand prolonged exposure—as long as 100 hours—with little effect on its properties. It also offers high resistance to creep at elevated temperatures. The material is available in the T8 temper, thus it can be used without further heat-treating.

Protective Coating for Metals Withstands Stamping and Hammering

Metal surfaces can be protected with a thin transparent coating by a single application of a chemical product followed by a bonding process according to PSC Inc., 303 Fifth Avenue, New York, N. Y. This coating prevents tarnish, oxidation, corrosion, and stains on silverplate, chromium, steel, aluminum, and other metals. The finish will not peel, crack, or chip and can be stamped or hammered in intermediate stages of manufacture. Soft abrasives and frequent washing and handling does not mar it. The coating is highly heat resistant and has great ductility.

The coating is chemically inert to most saline solutions, including ordinary salt water and industrial brines, dilute acids, many strong alkalis, organic solvents, foodstuffs, beverages, humidity, gases normally in air, and many sulphur compounds. Once bonded to a metal, it is non-toxic. The product can be used on plated, anodyzed, or plain surfaces and on metals containing organic dyes or inorganic dye coatings. It can be applied to any shape or form of metal part—plain, embossed, or etched—from wire to sheet. According to the producer, many companies can do the processing with the equipment they now have.

Alkaline Burnishing Compound for Zinc Die-Castings

An alkaline liquid compound which may be used for self-tumbling or with shot or synthetic media has been announced by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. Recommended concentration of solution for this "Oakite FM 186" compound is 1 to 2 per cent by volume. The compound is said to produce a bright finish and to improve the color of zinc die-castings. It may also be used for burnishing steel and copper and its alloys.

Build-up Material for Use Under Hard-Facing

A foundation material for building up carbon-steel parts prior to hard-facing has been made available by All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y. Called "Roll Matrix," it is available in electrode form. The material is alloyed to resist plastic deformation, upset, and overroll under the severest working conditions. It is effective in eliminating spalling of expensive overlay alloys. Arc-welding deposits exhibit a hardness of 30 Rockwell C and cannot be machined or forged unless preheated to 400 degrees F. or red heat, respectively.

The electrode is made for application as the first step in building up carbon-steel parts which have become excessively worn. Deposits from the electrode are intended to be overlaid with a harder alloy.

Steels containing 0.35 per cent to 0.90 per cent carbon, including those alloyed with chromium nickel, molybdenum, etc., can be rebuilt. It is customary to rebuild to a point where not more than 1/4-inch thickness of hard-facing material is required. Roll Matrix is available in 1/8-, 5/32-, 3/16-, and 1/4-inch core diameters.

Fragile Material Encased in Ice for Machining

In the aircraft industry, many vital parts are reinforced with a tissue-thin metal honeycomb material that provides great strength in relation to its weight. Unfortunately, however, the substance—which resembles the bee-product in appearance—has a tendency to deform under the impact of a cutter during many operations. Northrop Aircraft, Inc., Hawthorne, Calif., has overcome this difficulty in a rather unusual manner by freezing the material into a medium of ice before any machining is attempted.

Water is poured into the cells of the metal honeycomb. A refrigeration unit that has been coupled to a standard milling machine solidifies the liquid in a few minutes. Bevels, slots, or any desired contours may then be readily and smoothly cut into the frozen mass. The rotating cutting tool which is employed to shear the work is similar in many respects to a small circular meat-slicing blade.

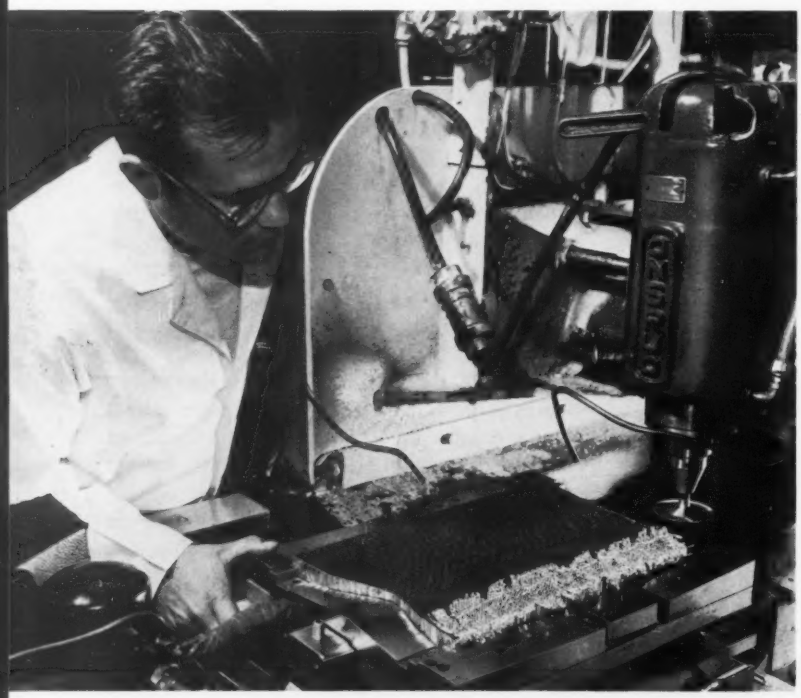


Fig. 1. (Above) Water is poured into the grillwork of the tissue-thin part, prior to milling. The refrigerating unit shown in the foreground is used to freeze the water solid.

Fig. 2. (Left) Ice surrounds and supports the thin membranes of the metal honeycomb material as it is being machined by the circular cutter.

Transfer-Feed Principle Adapted to Smaller Presses

IN the field of metal stamping, there are many facets to the problem of efficient production. Certainly, the principal ingredient is automatic handling of the parts before, between, and after the various press operations. For very small stampings, progressive dies provide the solution. For very large parts, the automotive type press line, consisting of individual machines tied together with electrically synchronized material-handling equipment, has been devised. For the broad category between the very large and the very small, transfer-feed press equipment provides the answer.

Few companies have extremely high production requirements of identical parts year after year in order to justify an expenditure for single-purpose automatic equipment. The common need is for versatile equipment which will produce a variety of stampings in the normal course of production; equipment which will not become a white elephant whenever there is a major change made in the design of the part produced.

A transfer-feed mechanism designed for presses of 75- to 300-ton capacities extends a high-production sequential stamping technique to a varied class of small work. Builder of the equipment is the Clearing Machine Corporation, Division of U. S. Industries, Chicago, Ill.

In Fig. 1 is shown a two-point, 250-ton "Transflex" press, with a bed area of 96 by 36 inches. The transfer-feed mechanism can be seen mounted on the right-hand side of the press. Like the larger models of these presses, the mechanical movements involve advancing the work through a series of die stations which perform different operations. Since there is a work-piece at each station, one work-piece is completed, and a new one loaded, for each press stroke.

How these movements are set up is best explained by referring to the cut-away view of the transfer-feed mechanism, Fig. 2. Power take off from the crown of the press is through a vertical shaft. By means of miter gears, the rotation extends to a horizontal shaft on which are keyed two cams—one for a return-advance movement and one for a clamp-unclamp movement.

The return-advance cam creates a side-to-side reciprocation of a carrier supporting two drive tubes, one extending along the front of the press bed, and the other along the rear. Stroke length of the carrier—governed by the number of die stations used—is controlled by an adjusting screw on the follower of the return-advance cam. An air cylinder in the center of the carrier pre-loads the follower to keep it in constant contact with its cam.

Coordinated with this movement of the drive tubes is a movement in unison of their two respective finger bars toward, or away from, the press center line. Along each bar is a row of equally spaced fingers, one at each die station. During that part of the press cycle when the work-pieces are to be advanced, the bars first

Fig. 1. Movements of the drive tubes and finger bars originate from the transfer-feed mechanism on the right-hand side of the press.

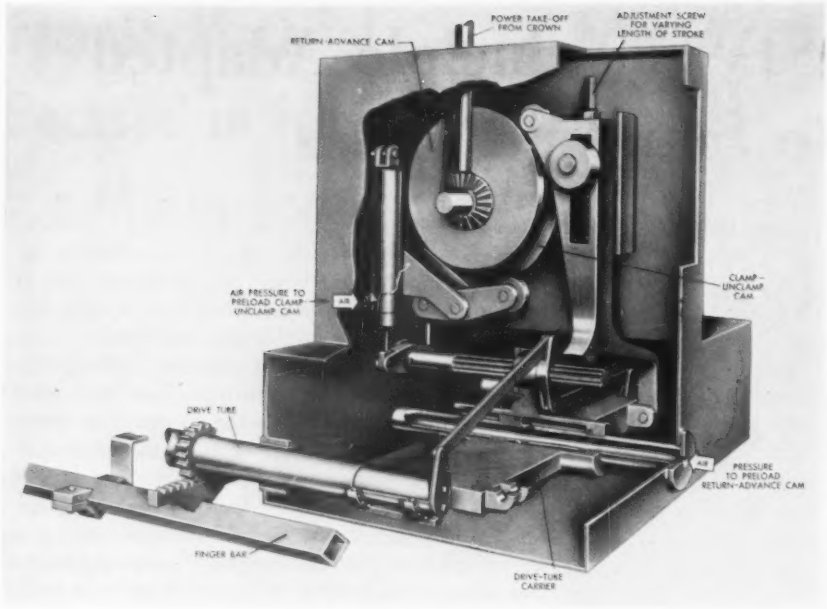


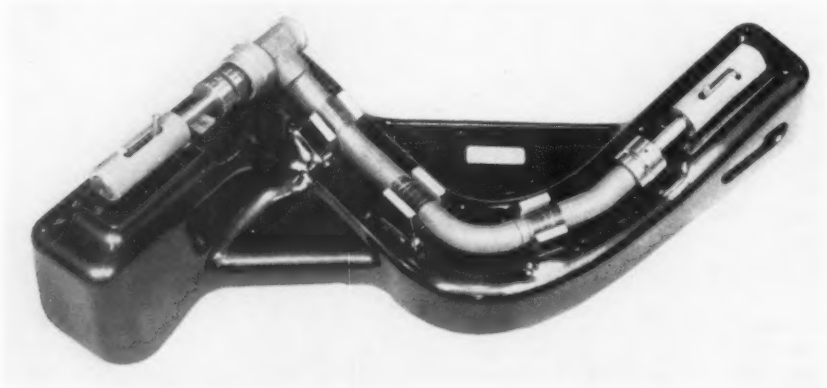
Fig. 2. One cam reciprocates the carrier, and another cam oscillates the drive tubes.

move toward the press center line until the fingers clamp the work. With the work thus secured, drive tubes and bars move as a unit along the press bed until the work is at the next die station. Next, bars retract, and drive tubes and bars move back to their initial position. Upon completion of the press stroke, movements are repeated.

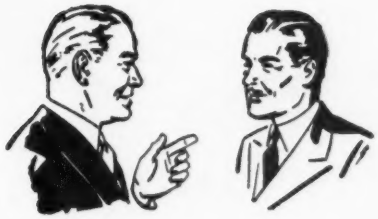
The in-and-out movement of the finger bars is derived from the clamp-unclamp cam. Through follower linkage, the movement of the cam is converted to oscillate a splined shaft. Additional linkage, in turn, reproduces this oscillation in the drive tubes. Pinions on the tubes power racks on the finger bars. Like the follower of the return-advance cam, the clamp-unclamp cam follower is pre-loaded from an air cylinder.

Tube-Contour Gages of Fiber-Glass Cloth and Plastic

Fabrication of tube-contour checking gages made of lightweight fiber-glass cloth covered by Renite plastic has provided significant cost and operating advantages at the Aircraft Engine Division of Ford Motor Co., Chicago, Ill. Previously, these gages were made of either steel or cast phenolic materials. Steel gages required detailed design drawings, while the new type gages do not, since they are fabricated with the use of a master tube. Also, average cost for the new gage is only one-third that of a steel gage. Renite gages far excel the others with regard to normal wear, and they will not change in size or warp in normal use.



Lightweight, low-cost gage made of fiber-glass cloth, covered with plastic, for checking the contour of bent tubes.



Talking With Sales Managers

By **BERNARD LESTER**
Management Consulting Engineer

Prescription to Help Sales Engineers Grow

"Every so often I try to discuss with each man his progress. To what extent do you feel this should be formalized?" This sales manager touched a really important button in the communication circuit of sales control. A periodic review of what has not been done in attaining previously set up goals is essential. These talks between two men should be strictly informal but should occur at regular intervals.

To illustrate a plan for periodic discussions between manager and man, let us tear out a page from the experience diary of the writer. After revision through trial and error, the following plan became established practice.

Once every six months each man and the department manager got into a private pre-scheduled huddle. This usually lasted at least an hour. The chief purpose was made crystal clear. It was to identify what interfered with progress and growth; to establish ways of improvement; and to set up goals for attainment—corrective or inceptive.

What took place during the interview was not a matter of rote, but certain guiding principles of procedure were followed. Don't get the idea that inquisitions were held! Every effort was made to attain equality in approach. Conversation passed both ways, over the same untapped wire. Intimacy, sincerity, and security against gossip were essential.

Mature members of the sales department participating in these discussions were occasionally asked to suggest ways in which the manager could improve his operations—even his behavior—to benefit all. This technique, when originally tried, came as a surprise to some department members. Besides helping the manager, it opened the way to a discussion, first of the strengths and then of the weaknesses of the conversational partner. Such a procedure paved the way to set up goals of improvement. The degree of attainment became a prime subject of discussion at subsequent sessions.

The following descriptive notes on a plan of this sort may help:

The frequency of discussion will vary from one company to another, or according to the age and experience of the men. Three months to one year are the common outer limits.

Treat each discussion period of first importance. Don't clip it short. Let only an emergency interfere.

Each discussion period must be kept to the salient points. Forbid other subjects that the sales engineer may be inclined to bring up.

Welcome original ideas, but apply the acid test to their practical application.

Don't get embroiled in criticizing others. After all, sales skill is measured by overcoming resistance of every sort.

Only fools admit they can't improve. So consolidate gains, formulate plans, and set up goals marked with time-tags.

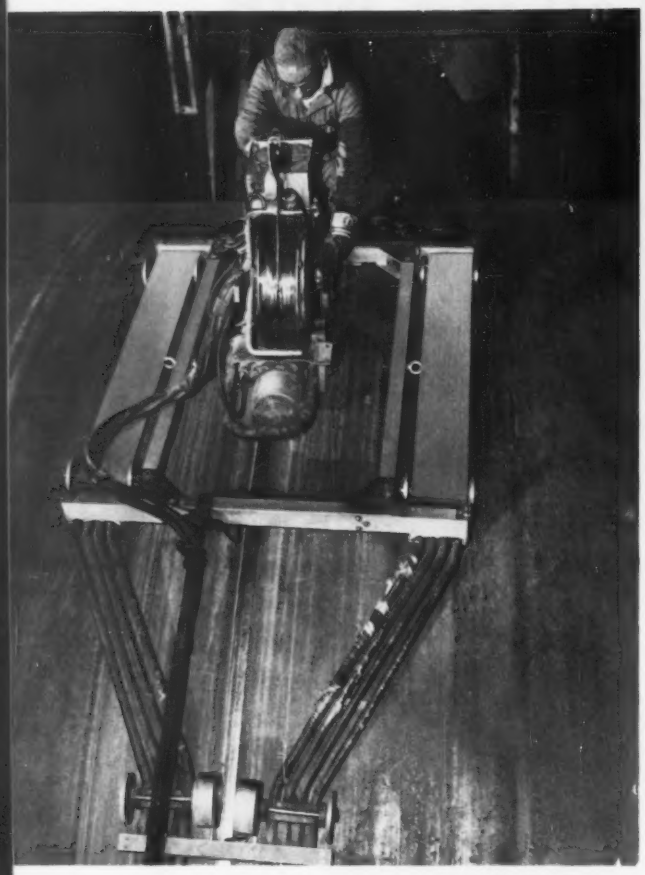
Though the matter of individual sales compensation is bound to come up, let this question stand out—how can performance and behavior lead to more pay?

The scheduled interviews considered here apply only to supervisor and supervised. Endless trouble would come from upsetting the flow of organizational responsibility. Also, the purpose may fall flat should a third person be present.

Two opinions are often expressed when we advocate the foregoing program for manpower building:

First, some sales managers claim they haven't the time for such a series of conferences. This stand is preposterous, since it assumes men are neither creative nor capable of improvement. Most sales officials have supervisors reporting to them. Supervision may stand first as a responsibility for serious discussion and the setting up of goals. Most of us need training in both supervision and accountability.

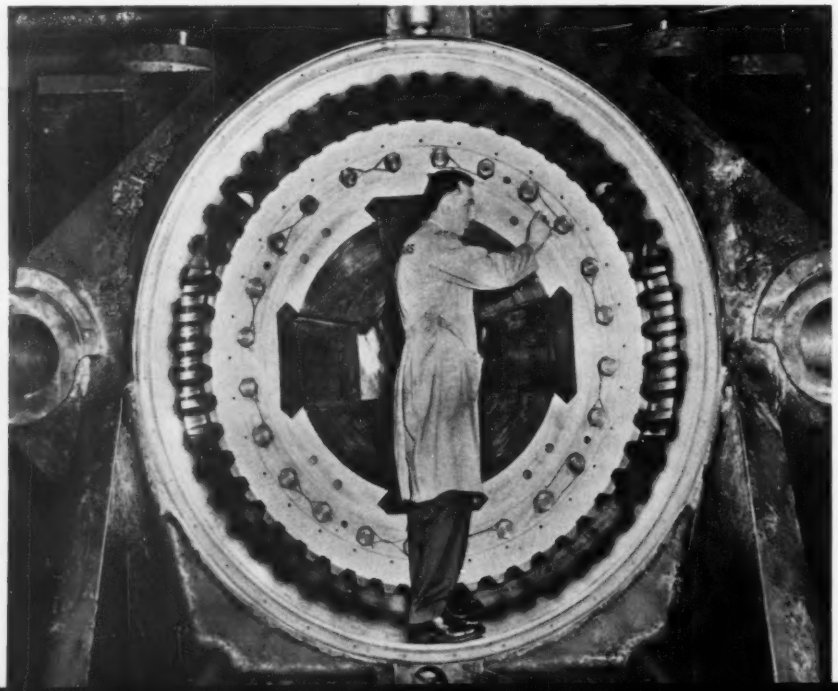
Men at various levels repeatedly point out that this sort of plan does work. "Above all," a sales manager told the writer, "it has strengthened me by giving me a much clearer understanding of my associates and the forces that motivate them. The experience, besides making me wiser and more patient, has got me really busy developing a better atmosphere in which men grow."

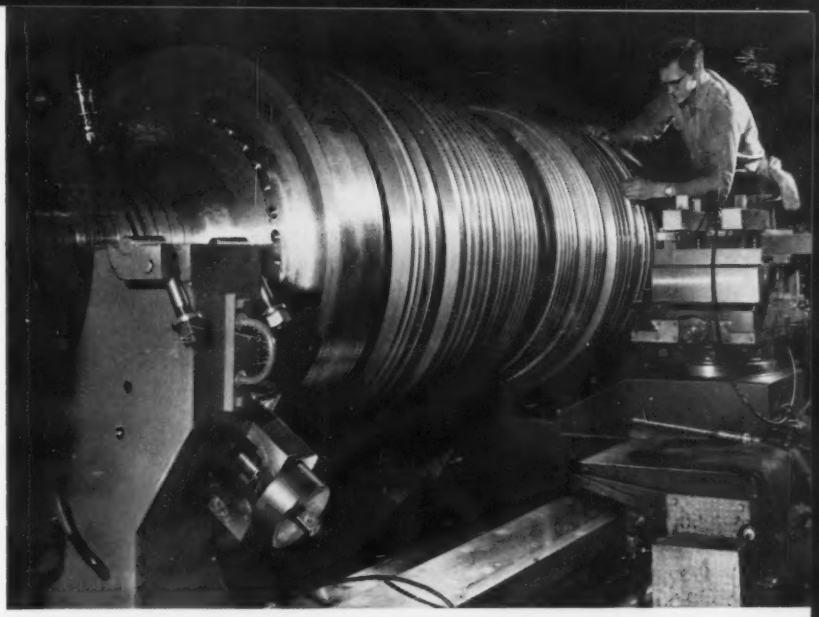


Camera highlights of some interesting operations performed in various metalworking plants throughout the nation

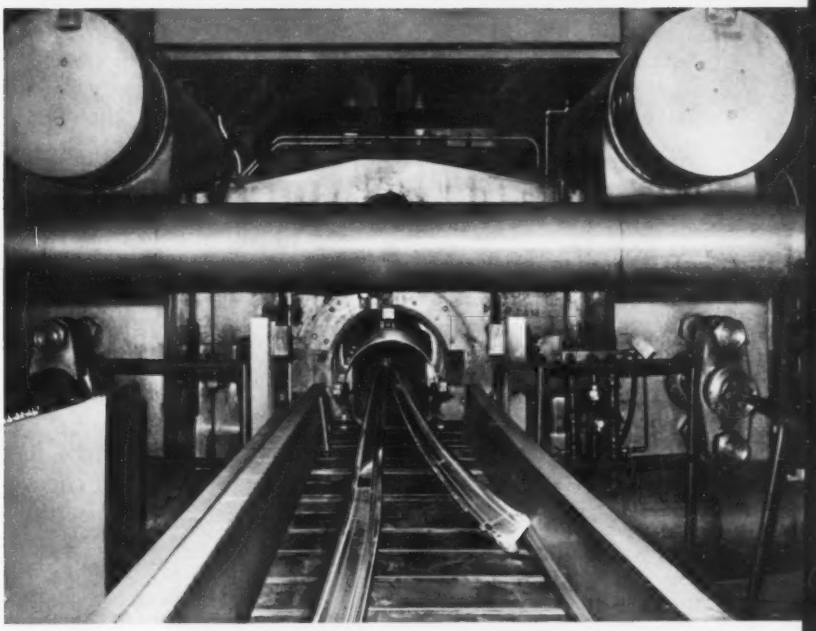
Hull sections for the United States Navy's new atomic-powered submarine, SKATE, are butt-welded with Lincoln submerged-arc equipment at the Electric Boat Division, General Dynamics Corporation, Groton, Conn. The welding carriage is held stationary by straps to the floor as the hull is rotated beneath it by power-driven rollers. Induction coils on each side of the joint preheat the sections.

A huge gear set for a 1500-ton Lombard stretcher undergoes final assembly at the Michigan Tool Co., Detroit. Unique Cone-Drive design wraps two worms around the gear. Each worm will be driven through a speed reducer by a 100-H.P. motor. Running and static torque ratings are 20,000,000 and 30,000,000 inch-pounds, respectively, yet gear set center distance is only 44 inches.

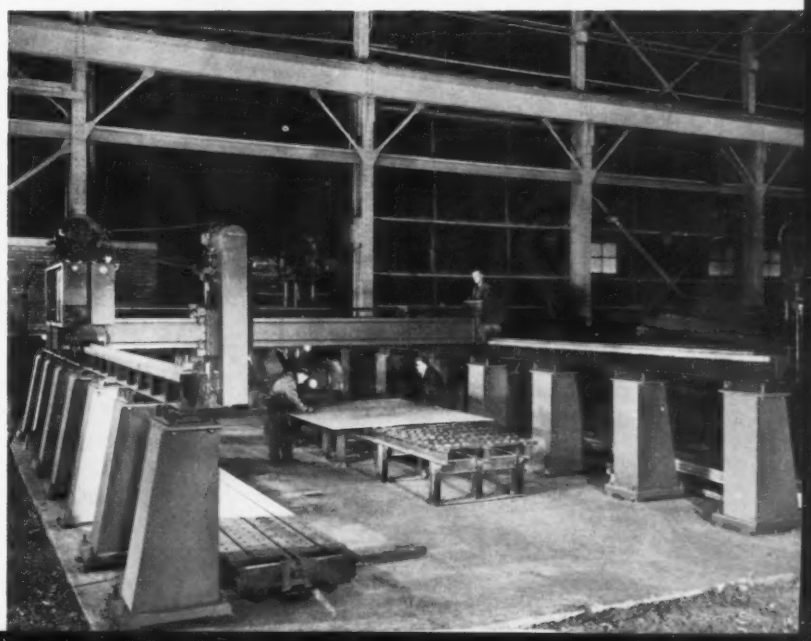




Grooving a 26-ton spindle on a 72-inch electronically fed heavy-duty lathe at Allis-Chalmers Mfg. Co., Milwaukee, Wis. Later, ends of spindle are milled and broached to receive blades. The spindle, of alloy steel, is for a 150,000-K.W., 3600-R.P.M. steam turbine.



Like toothpaste squeezed from a tube, double-Z bars of aluminum are extruded from the West Coast's first big Air Force press. Over 8000 tons of pressure can be exerted by the press, installed at Harvey Aluminum, Torrance, Calif. It was built by the Loewy-Hydropress Division, Baldwin-Lima-Hamilton.



Abrasive discs cut stainless-steel plate to size on a Ty-Sa-Man machine at the Chicago plant of Joseph T. Ryerson & Son, Inc. Two cutting units are mounted at right angles to each other on the same carriage, assuring square, parallel work without further machining.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Accuracy of Numerical Computations—2

Addition and Subtraction. The accuracy of a sum of figures cannot be greater than that of the least accurate of the figures being added. It may be much less. Take the following example:

$$\begin{array}{r} 6.34 \\ 5.192 \\ 3.1 \\ 8.9658 \\ \hline 23.5978 \end{array}$$

Presuming that each figure has been written down correctly to indicate its accuracy, the least accurate figure is 3.1. This figure is accurate only to the nearest tenth. Hence the answer can be expected to be accurate to the nearest tenth and should be written 23.6. Of course, if the above figures had been written

$$\begin{array}{r} 6.3400 \\ 5.1920 \\ 3.1000 \\ 8.9658 \\ \hline 23.5978 \end{array}$$

indicating that each had been measured to the nearest ten-thousandth, then the answer would be written as 23.5978. It should be recognized, however, that the error in any sum of figures may be greater than the error in any one of them. Thus, in the above example, if each of the figures being added had an error of plus or minus 0.00005, then the resulting errors might be:

+0.00005	+0.00005	−0.00005
+0.00005	−0.00005	−0.00005
+0.00005	−0.00005	−0.00005
+0.00005	+0.00005	−0.00005
+0.00020	0.0000	−0.00020

to give but three possible combinations. In the first case, the correct sum would be 23.5978 − 0.0002 = 23.5976; in the second case, it would be 23.5978 + 0.0000 = 23.5978; and in the third case, it would be 23.5978 + 0.0002 = 23.5980. Thus, it can be seen that the sum of a group of figures measured to the nearest ten-thousandth may or may not be correct to the nearest ten-thousandth. It is frequently assumed, however, that in adding a long column of figures there is a more or less equal distribution of plus and minus errors which tend to balance each other out. This depends, of course, on the type of data which the figures represent. In some cases where a small number of figures of equal accuracy are added, the last place in their sum is rounded off as being inaccurate.

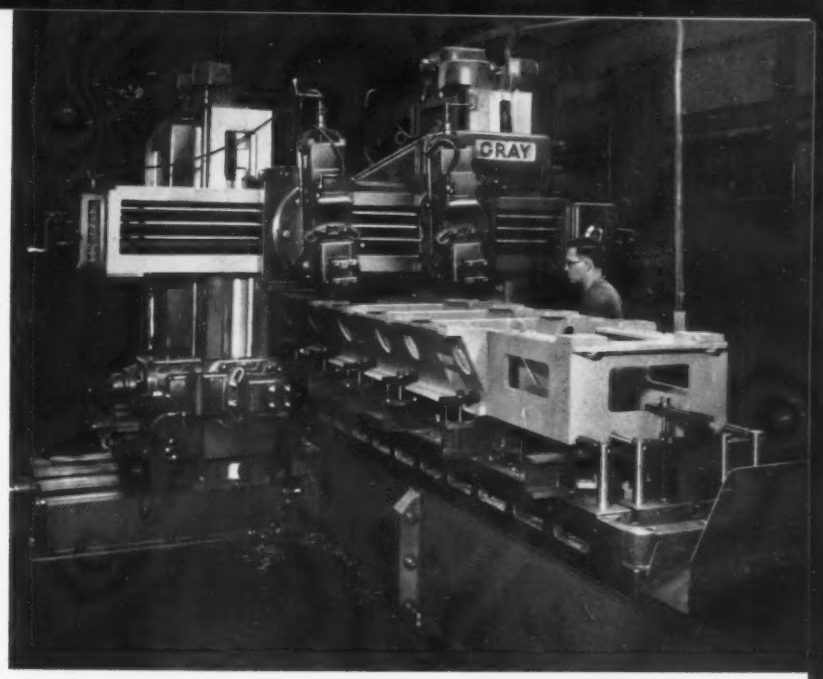
These same general considerations apply in the case of subtraction except that, since only two numbers are usually involved, there is less chance for a balancing out of errors, but also less chance for a large accumulated error.

Multiplication. The accuracy of the product of two figures may be much less than the accuracy of either due to the compounding of the error in each, thus:

$$\begin{array}{r} 12.31 \pm 0.005 \\ 1.05 \pm 0.005 \\ \hline 6155 \\ 12310 \\ \hline 12.9255 \end{array}$$

In the first place, the product should be expressed to an accuracy of one decimal place less than that of the least accurate of its factors. Hence, the above answer should be written 12.9. To indicate the possible error in the product of the above figures, let it be assumed that each figure was in error by +0.005 inch. Then, the resulting error e in the product would be found by the equation $e = 12.31 \times 0.005 + 1.05 \times 0.005 + 0.005 \times 0.005$. Neglecting the last term, which is too small to materially affect the total error, e = 0.0668, which is considerably more than the error of either factor. *(To be continued)*

Triple-Cut Planing Means High Production



TAKING heavy cuts in both directions with equal speeds, equal feeds, and equal depths of cut is an important feature of universal planers brought out by the G. A. Gray Co., Cincinnati, Ohio. By actuating a lever and a button, the planers, which are manufactured in both double-housing and open-side design, are converted from a double-cutting action to conventional heavy-duty planing with a standard single-point tool. The double-cutting tool uses standard carbide tips so that conventional toolroom procedures can be followed.

The double-cutting technique can be combined with the regular single-cutting action to obtain triple-cut planing. Rough- and semifinish-planing are accomplished at the same time. Roughing is performed by a double-cutting tool, while semi-finishing is done by a single-point broad-nose tool. If the work surface requires an especially fine finish, a second pass can be made with the same broad-nose tool.

An example of the triple-cutting technique can be seen in Fig. 1. On the table of this 30-inch by 12-foot universal open-side planer are two steel rack blanks. The double-cutting tool is shown beneath the rail-head in Fig. 2. In the illustration, the forward carbide tip is cutting.

At the end of each stroke, the double-cutting tool is automatically rotated through an arc of approximately 13 degrees until it strikes a large, positive stop. This movement permits the second carbide tip to engage the work when the table is fed in the opposite direction. At the same time, adequate clearance is provided.

The conventional broad-nose semifinishing tool is mounted in the tool box ahead of the double-cutting tool. It is set to a depth slightly below the double-cut roughing tool and lags behind that tool by a fraction of an inch, in the direction of head feed.

An interesting installation of a Gray universal

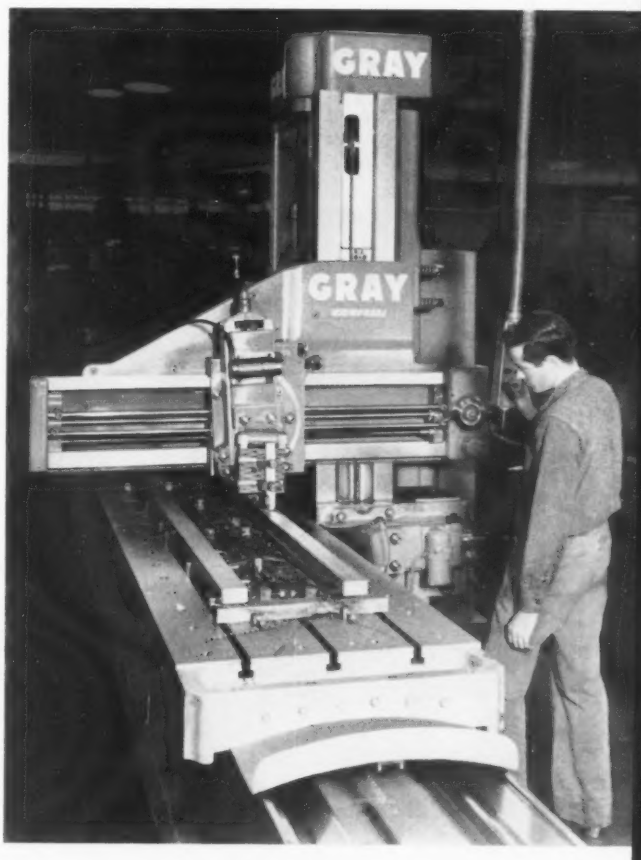
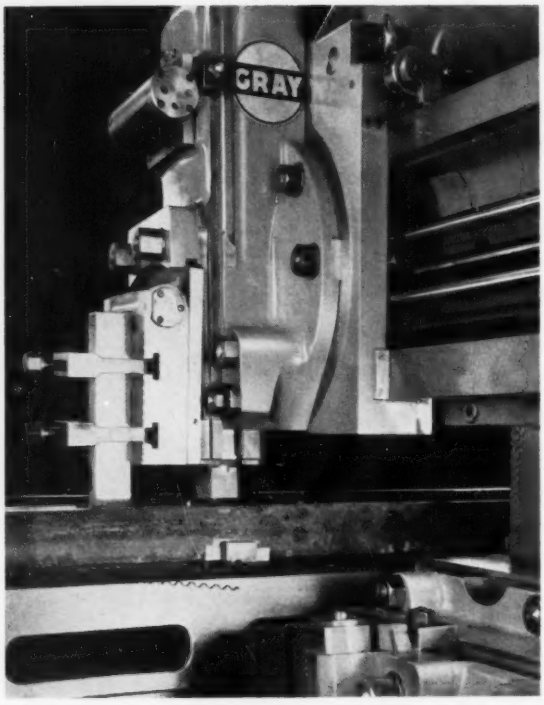


Fig. 1. Steel blanks for racks are being machined on this 30-inch by 12-foot universal open-side planer. A triple-cutting technique is used.

Fig. 2. Tooling on the rail-head. The double cutting tool-holder beneath the head roughs in two directions, while the broad-nose tool semifinishes in one direction.



planer is found at the Textile Machine Works, Reading, Pa. The machine, shown in the heading illustration, is a 36-inch by 20-foot adjustable, convertible open-side planer. To increase its versatility, the left-hand (auxiliary) housing rides on slides on its outboard runway. This housing can be moved in for narrow work, or moved out for wide work. Rigidity of the machine is materially increased by the support afforded by the left-hand housing. Should it become necessary to handle unusually wide jobs, the auxiliary housing can be removed from the machine to give additional work-handling room.

The table on the illustrated planer is split. While a casting is being machined on one section, the other section is set aside, unloaded, and reloaded. Thus, on jobs where the setup time is equal to the machining time, the setup time is virtually eliminated.

Tensile strength (core) of the textile machine base shown being machined is 34,000 pounds per square inch. This is coupled with a surface hardness ranging from 401 to 444 Brinell when tested with a standard 10-millimeter ball under a 3000 kilogram load.

A 1/2-inch deep cut is taken with a feed of 0.050 inch per stroke—0.100 inch per cycle with double cutting. Cutting speed averages 200 feet per minute. By utilizing double- and triple-cutting techniques, floor-to-floor time has been reduced from sixty-two hours to the present time of twelve hours. Textile Machine Works have developed a variation of the double-cut tool-holder to accommodate smaller, clamp-on type, throw-away carbide tips. This tool-holder is shown in Fig. 3. For clarity, the clamps have been eliminated from both the front and plan views.

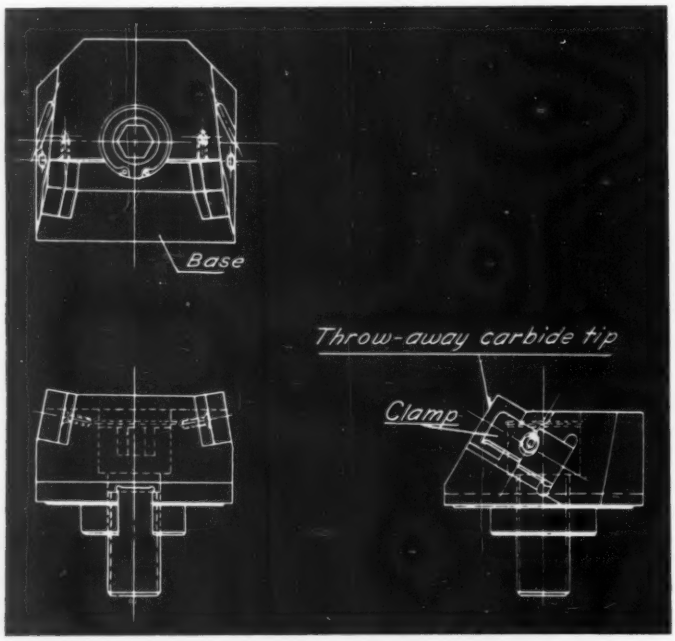


Fig. 3. Specially designed double-cut tool-holder for mounting on the under side of the rail-head. This tool permits the use of clamp-on type, throw-away carbide tips.

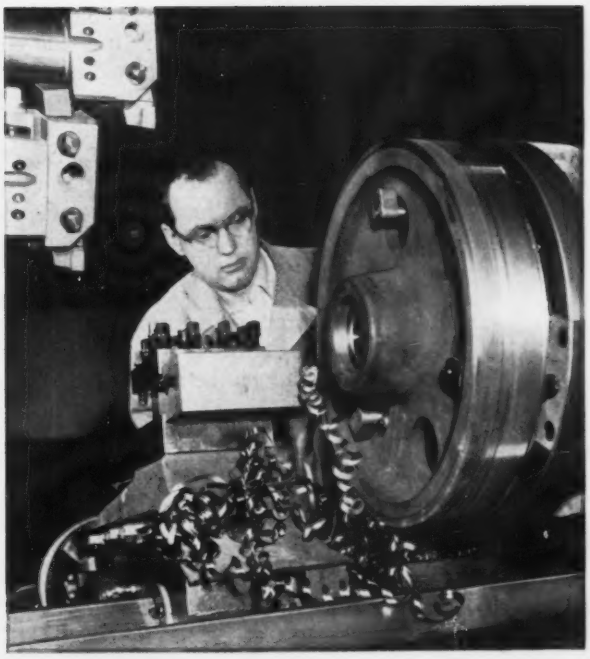
MACHINERY'S

Reference Section

March 1957

How Are YOUR Carbide Tools Performing?

Part 2



How Are YOUR Carbide Tools Performing?

Shape, speed, feed, depth of cut, and the influence of cutting fluid are all determinants in the productive life of a turning tool. In this second and final article on carbide performance, the effect of these factors on cutting forces and tool life, as documented by extensive test results, will be presented.

IN the first part of this series, appearing in January MACHINERY, page 165, results of laboratory tests were considered in which identical rake angles were maintained while the type of chip-breaker was varied. It was found that although the cutting forces were influenced significantly by chip-breaker design, the tool life, as represented by a 0.030-inch wear land, remained the same.

In the ensuing paragraphs, the results of a large number of tests with tools of varying rake angles are presented. All tools were of steel-cutting grade carbide (C-6) and tested under the following conditions:

Cutting speed	1000 feet per minute
Depth of cut	1/8 inch
Feed	0.015 inch per revolution
Work material	AISI 1020 steel
Cutting fluid	none

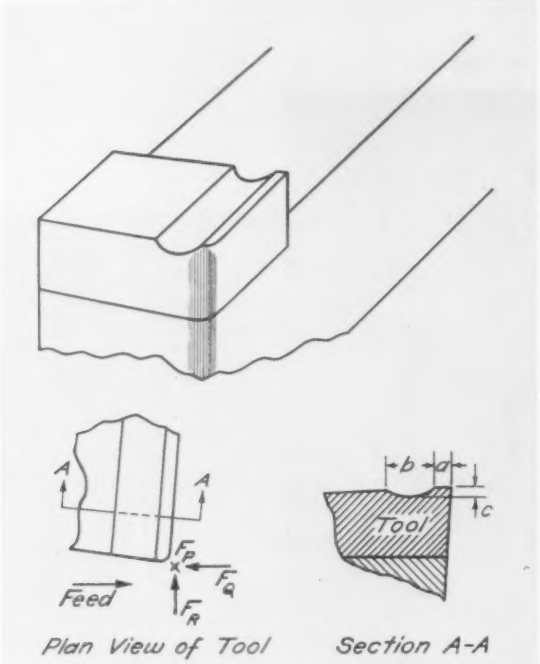


Fig. 4. This carbide turning tool is ground with a land and groove type chip-breaker. The dimensions of the chip-breaker are varied to obtain the test results listed in Table 1.

Tests Were Divided into Three Groups

Three series of tests were run:

1. Tests with tools having a land and groove type chip-breaker (Fig. 4 and Table 1).
2. Tests with tools having a land and groove type chip-breaker plus a chamfer extending back along the side cutting edge for a distance equal to half the depth of cut (Table 1, Tests 6 to 9).
3. Tests with tools having a shelf type chip-breaker (Fig. 5 and Table 2).

The results of all these tests are summarized in Tables 1 and 2. Forces F_P, F_Q, and F_R are the tangential, axial, and radial components, respectively, taken after the tool had been in use for five minutes. The specific energy consumed is expressed in terms of energy per unit volume (u) and horsepower per cubic inch per minute (K) and can be calculated by applying Equations (1), (2), and (3) (Part 1 of this article). The equations are as follows:

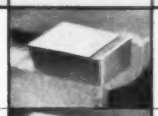
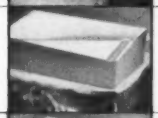
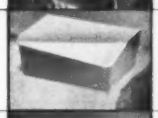
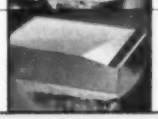
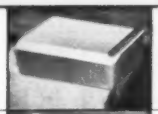
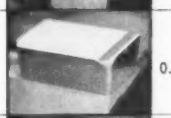
$$u = \frac{F_P V}{Vbt} \tag{4}$$

and

$$K = \frac{F_P V}{33{,}000\,(12)\,Vbt} = \frac{u}{396{,}000} \tag{5}$$

where V = cutting speed in feet per minute;
b = depth of cut in inches;
t = feed in inches per revolution.

TABLE 1 RESULTS OF TESTS ON CARBIDE TURNING TOOLS HAVING LAND AND GROOVE TYPE CHIP-BREAKERS*

Test No.	Tool Photograph†	Chip-Breaker Dimensions, Inch‡			Tool Angles, Degrees§		Tool Forces, Pounds			Specific Energy		Tool Life, Minutes ‖		Rake Angle Chamfer, Degrees§	
		a	b	c	s	b	F_P	F_Q	F_R	in. lb. / cu. in.	H.P./ cu. in./ min.	5 10 15 20	Average	s	b
1		0.020	0.060	0.010	6	0	420	100	40	224,000	0.56		12.0		
2		0.012	0.050	0.003	6	-10	570	210	70	303,000	0.77		18		
3		0.010	0.060	0.003	6	-15	620	220	115	330,000	0.83		17.4		
4		0.012	0.050	0.003	-6	0	780	340	90	415,000	1.05		c		
5		0.010	0.050	0.003	-6	-6	660	320	90	351,000	0.89		14.2		
Tools with Chamfer Extending One-half Depth of Cut along Side Cutting Edge															
6		0.015	0.050	0.010	6	0	490	120	60	260,000	0.66		17	-6	-30
7		0.012	0.050	0.003	6	0	580	240	95	308,000	0.78		c	-6	-20
8		0.015	0.050	0.010	6	0	570	220	110	303,000	0.77		8.3	-10	-30
9		0.007	0.035	0.003	6	0	570	220	110	303,000	0.77		12.7	-10	-30

* Tests made with tool shown in Fig. 4 at a cutting speed of 1000 feet per minute, a depth of cut of 1/8 inch, and a feed of 0.015 inch per revolution. Work material AISI 1020 steel, cut dry. Tools were ground with a side cutting-edge angle of 10 degrees, an end cutting-edge angle of 15 degrees, a relief angle of 6 degrees, and a nose radius of 1/64 inch.

† Tool photographs are oriented so that the side cutting edge of the tool is directed toward the upper right-hand corner.

‡ Dimensions a, b, and c refer to the chip-breaker shown in Fig. 4.

§ s = side rake angle, b = back rake angle.

‖ Based on a 0.030-inch wear land.

X Tool totally destroyed before 0.030-inch wear land was obtained.

c Test discontinued because of excessive chatter.

TABLE 2. RESULTS OF TESTS ON CARBIDE TURNING TOOLS HAVING SHELF TYPE CHIP-BREAKERS *

Test No.	Tool Photograph†	Chip-Breaker Dimensions, Inch ‡		Tool Angles, Degrees §		Tool Forces, Pounds			Specific Energy		Tool Life, Minutes‖	
		b	c	s	b	F_P	F_Q	F_R	in. lb. / cu. in.	H.P./ cu. in./ min.	5 10 15 20	Average
10		0.125	0.015	6	0	530	180	40	282,000	0.71		11.2
11#		0.125	0.015	6	0	530	180	40	282,000	0.71		12.4
12		0.094	0.016	6	-6	520	180	60	277,000	0.70		12.9
13		0.094	0.044	6	-15	550	200	100	292,000	0.73		18.5

* Tests made with tool shown in Fig. 5 at a cutting speed of 1000 feet per minute, a depth of cut of 1/8 inch, and a feed of 0.015 inch per revolution. Work material AISI 1020 steel, cut dry. Tools were ground with a side cutting-edge angle of 15 degrees, a relief angle of 6 degrees, and a nose radius of 1/64 inch.

† Tool photographs are oriented so that the side cutting edge of the tool is directed toward the upper right-hand corner.

‡ Dimensions b and c refer to the chip-breaker shown in Fig. 5

§ s = side rake angle, b = back rake angle.

‖ Based on a 0.030-inch wear land.

Chip-breaker step ground at an angle of 10 degrees to the side cutting edge.

X Tool totally destroyed before 0.030-inch wear land was obtained.

Tool life values (time in minutes required to develop 0.030-inch wear land) for the individual tests are shown by bar graphs in Tables 1 and 2. Average tool life values are also given. Considerable variation in individual tool life values was noted—the better tools lasting up to twenty-five minutes and the poorer tools, under five minutes.

Specific cutting energy is seen to increase significantly with a decrease of side rake angle. However, changes in back rake angle have much less influence on specific energy and the result of increasing this angle is sometimes to decrease the specific energy and sometimes to increase it.

The tool life values for Tests 2, 3, 6, and 13 are relatively good. It is significant to note that in all of these tests a positive side rake angle is combined with an effective negative back rake angle. In Test 6, the negative 30-degree back rake chamfer with the 0-degree back rake main surface combine to provide an effective negative back rake angle of about 15 degrees.

It appears that two opposing trends are operative in determining the optimum rake angles:

1. A decrease in specific energy with an increasing rake angle.
2. An increase in metal (size of the included angle) at the tool point with a decreasing rake angle.

While changes in back and side rake angles are equally effective with regard to Item 2, changes in the side rake angle are more important with regard to Item 1. It would then appear advantageous to increase the side rake angle to positive values in order to reduce the specific energy, while decreasing the back rake angle in order to offset the loss of metal at the tool point associated with the increase in side rake angle.

Although the tool used in Test 13 had relatively long life, the chips tended to slide down onto the finished surface, thus marring it. This difficulty was not encountered with the tools used in Tests 2, 3, or 6 due to the action of the chip-breakers. However, inasmuch as the tool in Test 6 operated with much less specific energy than the tools in either Test 2 or 3, it is the preferable design since it should operate at a lower temperature and thus provide a greater factor of safety

against total destruction. Surface finish was found to vary directly with tool life. If a tool possesses maximum life, it should also yield the best finish.

Influence of Speed, Feed, and Depth of Cut

The relative influence of cutting speed, feed, and depth of cut on the life of a carbide tool during high-speed turning operations also underwent laboratory investigation. Tool geometry was constant in all tests at the values used in Test 7, Table 1, which correspond to the following:

Side rake angle	6 degrees
Back rake angle	0 degree
Chamfer dimensions:	
extent along side cutting edge	0.0075 inch
inclination in side rake direction	6 degrees
inclination in back rake direction	20 degrees
Side cutting-edge angle	10 degrees
End cutting-edge angle	15 degrees
Relief angles	6 degrees
Nose radius	1/64 inch

A sketch of this cutting tool is shown in Fig. 6 with the major cutting edge extending toward the upper right-hand corner. Two types of carbide were used—C-6, which is a general-purpose steel-cutting grade, and C-8, which is a harder grade. The moderate chatter previously experienced with this cutter, as indicated in Table 1, was subsequently eliminated through improved clamping of the cutter shank, thus permitting the other excellent operating characteristics of this cutter style to be utilized. The following standard cutting conditions were maintained:

Cutting speed	1000 feet per minute
Feed	0.015 inch per revolution
Depth of cut	1/8 inch
All cutting was done dry unless otherwise noted.	

Only one of these basic conditions was varied at a time to observe its effect on tool life.

Tool Life Results

As was the case with previous tests, tool life was considered ended when the wear land on the clearance surface reached a value of 0.030 inch. Data obtained when speed, feed, and depth of cut were each separately varied are given in graph form in Fig. 7. The circled points correspond to the standard conditions referred to.

It can be seen in the illustration that the data points approximate a straight line, except in the regions covered by broken lines. Although the plot of log-log of tool life T versus the log of speed V is often a straight line, it will not always be so at lower speeds, feeds, or depths of cut; in fact, in the practical operating range of the variables it is more common to have curvature in the feed and depth of cut tool life curves.

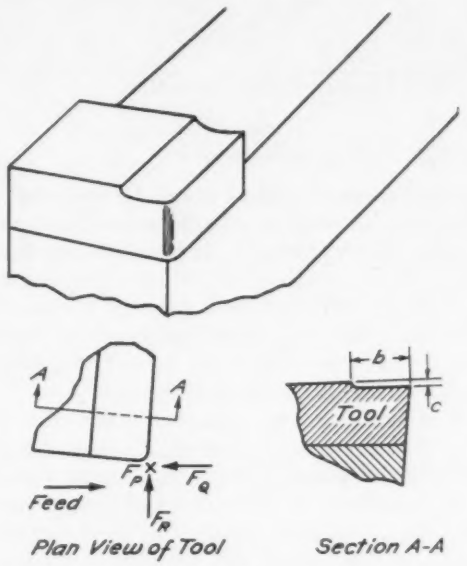


Fig. 5. A shelf type chip-breaker is ground on this carbide turning tool. In Table 2 are listed the results of tests run when the chip-breaker style was varied.

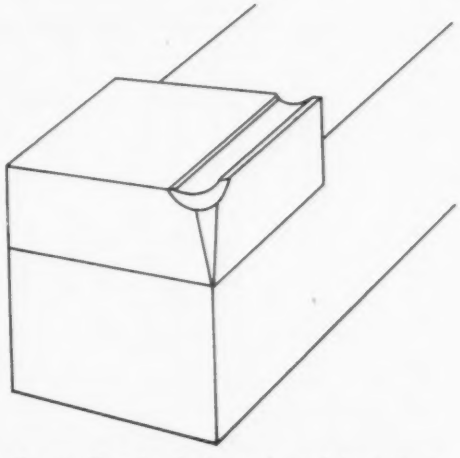


Fig. 6. Sketch of the tool used in tests to determine the effect of speed, feed, and depth of cut on cutting forces and tool life. The tool is listed under Test 7 in Table 1.

The approximately straight-line portions of the tool life curves (shown solid) correspond to the following type of equation:

$$T = \frac{\text{constant}}{V^a t^b b^c} \quad (6)$$

The particular equations for each of the tool materials tested follow:

For the C-6 tool material:

$$T = \frac{6.55 \times 10^{15}}{V^7 t^{3.2} b^{0.46}} \quad (7)$$

For the harder C-8 tool material:

$$T = \frac{1{:}69 \times 10^{18}}{V^{11.2} t^{1.78} b^{1.66}} \quad (8)$$

From these equations it can be seen that tool life varies inversely to a high power of the cutting speed, a lower power of the feed, and a still lower power of the depth of cut. When the speed is cut in half with the C-6 tool, the tool life increases 130 times. Similarly, when the feed and depth of cut are each separately cut in half, the tool life increases 9 and 1.4 times, respectively.

The harder, more refractory grade of carbide is seen to have far better tool life than the softer carbide and should, therefore, be used whenever it is possible to do so without chipping the cutting edge. Use of the harder grades of carbide requires a rigid setup and freedom from runout, scale, and shock loading of the cutting edge.

The cutting speed recommended in the ASME Manual on Cutting of Metals for the standard feed and depth of cut used in these tests (0.015 inch per revolution and 0.125 inch respectively) is 500 feet per minute for a work-piece of 156 Brinell hardness. This recommendation is for a general-purpose carbide tool of the C-6 type. It can be seen in Fig. 7 that this speed corresponds to a tool life of approximately seventy minutes—which is a very reasonable value.

Consequence of Improved Tool Life

If a harder carbide or an improved carbide tool is used, it should be possible to increase the rate of metal removal while keeping the tool life the same. The question which naturally arises is which variable is most advantageously increased to take advantage of the improved tool life that results from the improved tool material. Should the speed, feed, or depth of cut be increased?

The volume of metal removed in a given time is proportional to the product Vbt and, if the tool life is to remain constant, it is evident from Equation (7) or (8) that Vbt will be increased most if b is increased and least if V is increased. Thus, whenever a cutting operation is being performed under optimum conditions, an improvement in tool material should be utilized by first considering an increase in depth of cut, followed by an increase in feed, and last by an increase in cutting speed. It should not be arbitrarily assumed that an improvement in cutting tool material automatically means that the cutting speed should be increased.

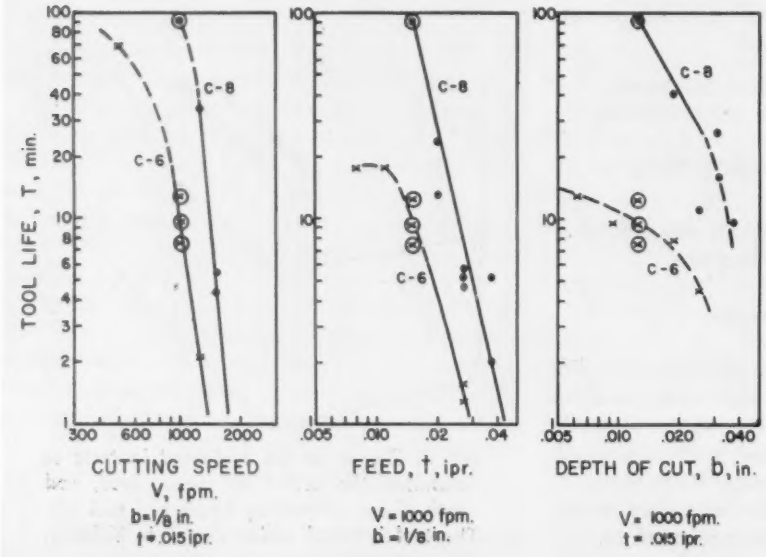


Fig. 7. Tool life data (0.030-inch wear land) for hot-rolled AISI 1020 steel that has been turned with both C-6 and C-8 type tungsten-carbide tools.

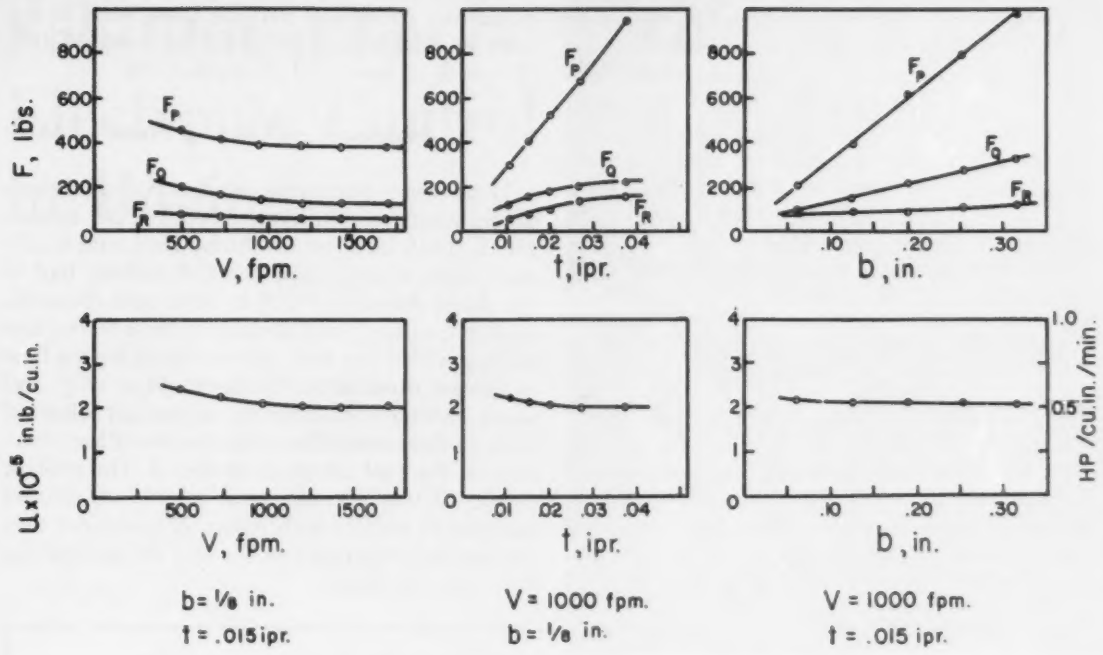


Fig. 8. Variation of cutting force values for C-6 type tungsten-carbide turning tool when the values of speed, feed, and depth of cut have been altered individually.

There are several considerations in addition to cost and rate of metal removal which determine whether speed, feed, or depth of cut should be varied. These include:

1. The maximum force the tool is capable of withstanding (cutting force is approximately proportional to depth of cut and feed but independent of cutting speed).
2. The amount of power available (power required varies approximately directly with the rate of metal removed (*Vbt*).
3. The amount of metal to be removed. This depends on the blueprint dimension and on the machining allowance.
4. The maximum feed that can be tolerated from the standpoint of the finish required.

Any decision to alter depth of cut, feed, or speed must be consistent with these considerations.

Cutting force values for the C-6 type carbide tool are shown in Fig. 8 for different values of speed, feed, and depth of cut. The force components F_P, F_Q, and F_R are for the tangential, feed, and radial directions, respectively. Component F_P is the most important one of the three since it determines the specific cutting energy (inch-pounds of work per cubic inch of metal removed) or specific horsepower consumed (horsepower

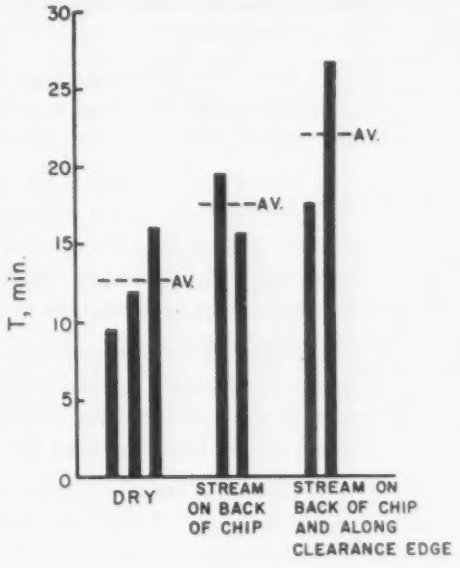


Fig. 9. The effect of a commercial soluble-oil cutting fluid (diluted one part in twenty with water) on a C-6 type carbide turning tool is clearly shown. For maximum tool life a copious flow must be maintained.

per cubic inch per minute). Both of these factors can be determined by referring back to Equations (4) and (5). Values of u and K are also shown plotted in Fig. 8, where it may be seen that these quantities are independent of speed V (at speeds above those that give rise to a built-up edge), decrease slightly with an increase in feed t, and are approximately independent of depth of cut b except at low values of b where the nose radius plays a relatively important role.

The energy dissipated per inch of cutting edge (U) is

$$U = \frac{u\,(Vbt)}{b} = uVT \qquad (9)$$

which is seen to be independent of depth of b. It is for this reason that depth of cut has so little effect on tool temperatures and hence on tool life. Equation (4) shows that u is independent of V but varies inversely with t. Thus the cutting energy per inch of cutting edge given in Equation (9) will be influenced by changes in V but not by changes in t. It is evident, therefore, that changes of cutting conditions may be considered as follows, in decreasing order of influence on tool life: (1) speed; (2) feed; and (3) depth of cut.

Influence of Cutting Fluid

Tests were performed under the aforementioned standard conditions (1000 feet per minute speed, 0.015 inch per revolution feed, and 0.125-inch depth of cut) using the C-6 carbide tool of the shape shown in Fig. 6 to determine the influence of a cutting fluid. Results of these tests when cutting with a dry tool, when cutting with a flow of coolant directed on the back of the chip, and when cutting with streams of coolant directed both on the back of the chip and along the clearance of the tool are given in Fig. 9. The coolant employed was a commercial soluble oil diluted one part in twenty with water. It is evident that the coolant improves tool life and the greater the flow rate, the better.

Conclusions Based on Results of the Extensive High-Speed Turning Tests Presented to Show Effect of Tool Shape, Speed, Feed, Depth of Cut, and Coolant on the Life of Carbide Tools

1. Side rake angles should be positive to limit tool forces and temperatures, while back rake angles should be negative to provide sufficient metal at the tool point.

2. Since the combination of a positive side rake angle and a negative back rake angle may lead to poor chip control, attention must be given to the type of chip-breaker used.

3. The use of a double back rake angle of minus 30 degrees for the first half depth of cut and 0 degree for the second half depth of cut, in conjunction with a land and groove type of chip-breaker, provides good chip-breaking and the desired large back rake angle without a tendency to throw the chip back onto the newly cut surface.

4. Although carbide tools can, in some instances, be made to perform at levels considerably beyond generally accepted practice, this does not necessarily mean that cutting speeds should be increased. Rather, increases in depth of cut, feed, and then speed should be considered in that order.

5. Cooling a carbide turning tool with a full flow of water-base coolant can give improved tool life over dry cutting. It is important that a large flow of coolant be used to prevent cooling only a portion of the tool, resulting in thermal stress gradients.

6. In carbide milling—where the repeated thermal shock associated with heating and cooling the tool causes fatigue of the cutting edges—it is generally found that poorer results are obtained with a coolant than without.

Pneumatic Device Substituted for Electronic Control in Honing

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AUTOMATIC gage-ring sizing is the commonly used method of determining when the desired inside diameter of work being finished on Microhoning machines has been reached. The majority of the gage-ring sizing devices now in use trigger an electronic control circuit to arrest the feeding action of the honing stones. Recently, however, the Micromatic Hone Corporation, Detroit, Mich., has begun to replace this electronic control feature with an air circuit that incorporates a novel pneumatic principle. The new air-switch gage-ring sizing units have been installed on honing machines in the plants of several automobile manufacturers and are helping to obtain closer accuracy while lowering maintenance costs.

How Gage-Ring Sizing Works

Honing is essentially a low-velocity abrading process that removes stock rapidly while holding size, geometry, and surface finish to close tolerances. Metal removal in the cylindrical honing process is accomplished by both rotating and reciprocating a number of honing stones (abrasive sticks) in contact with the bore of the work-piece. To increase the diameter of the bore, the tool is expanded by wedging a cone against the back of the abrasive sticks. This wedging action forces the abrasive sticks out radially with equal pressure in all directions.

Each of the abrasive sticks is encased in a plastic shell. Portions of these shells, called tabs, extend past both ends of the honing sticks and wear down evenly with them, so that the outside diameter of the tabs is always equal to the diameter of the bore being worked. In Fig. 1 is shown a cut-away view of an electronic size-control unit that functions by gaging the tool diameter. Gage ring *A*, having an inside diameter equal to the desired bore size of the part, is positioned above the work *B*, so that the upper tabs of the plastic shells around honing sticks *C* enter the ring at the top of each stroke.

As metal is removed from the bore surface of the work-piece, the individual abrasive sticks are pushed out, thereby increasing the diameter of the honing tool. When the tool expands to the point where it is the same size as the inside diameter of the gage ring, the plastic tabs will make contact. As a result, the gage ring will be caused to rotate slightly with the tool.

This rotation can be detected either electronically or pneumatically. With an electronic control system, the torque flexes a leaf spring *D*, Fig. 1, until it touches sizing contact *E*. An electronic circuit is then triggered to arrest the expansion of the hone. Since runout time (like spark-out on a grinding machine) is desired, an electronic timing circuit delays the final collapse and withdrawal of the tool for a pre-set number of seconds.

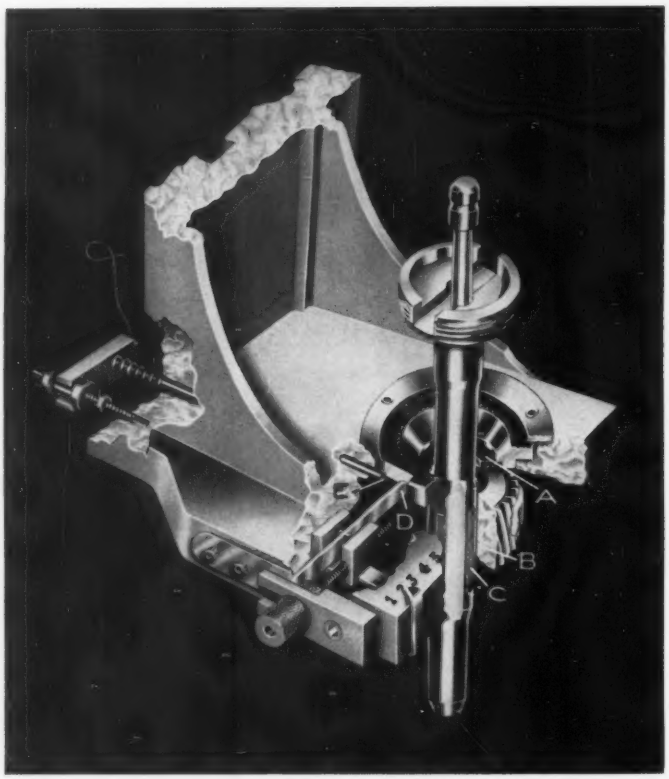


Fig. 1. Electronic size-control unit for a honing machine that operates by gaging the tool diameter. When the tool has expanded sufficiently to bind against gage ring (A), the ring will move. This forces leaf spring (D) up against contact (E) which halts hone expansion electronically.

Theory Behind the Pneumatic Size-Control System

Although the electronic pick-up has been used successfully for years, a pneumatic control system was desirable because there was need for a device that would

1. operate efficiently with water-soluble coolants;
2. not be affected by metallic particles and water in oil coolants;
3. lend itself to remote adjustment; and
4. eliminate the sizing leaf spring (which needed periodic replacement).

It is a known fact that as air travels through a pipe, a certain amount of energy is represented by the mass and the velocity of the air. If the flow is stopped suddenly, the air in the closed end of the circuit will compress to greater-than-line pressure and reflect a pulse (traveling at high speed) toward the opposite end of the pipe. This phenomenon is often observed audibly as hammering in water pipes when a faucet is suddenly closed.

The pulse will travel back through the pipe even if the downstream end is reopened. Such a pulse can be utilized to operate a sensitive pressure switch of the type used in pneumatic gaging systems. The speed with which this pulse actuates a switch is not noticeably affected by the length of the pipe.

Operation of the Air-Switch Control

In Fig. 2 can be seen a cut-away sketch of a gage-ring sizing bracket that has been designed to utilize an air pulse to detect the rapid movement of the gaging ring. Actual operation of the components can be better understood by referring to Fig. 3, which shows a schematic representation of the design.

Air from a supply source is first passed through a filter to remove any foreign particles that might hamper operation of the unit. The air then flows through a regulator that maintains a pressure ranging from 15 to 20 pounds per square inch. From the regulator the air flows through an adjustable restriction, through a flexible air line to the sizing bracket, into a ball-seat assembly and around the ball. It then passes between a plunger and the bracket wall and dissipates into the atmosphere through an air release hole.

Clearance between the plunger and the wall is such that a pressure of approximately 9 pounds per square inch is maintained behind the plunger. A sensitive pressure switch, connected to the feed-stop control of the honing machine, is in the

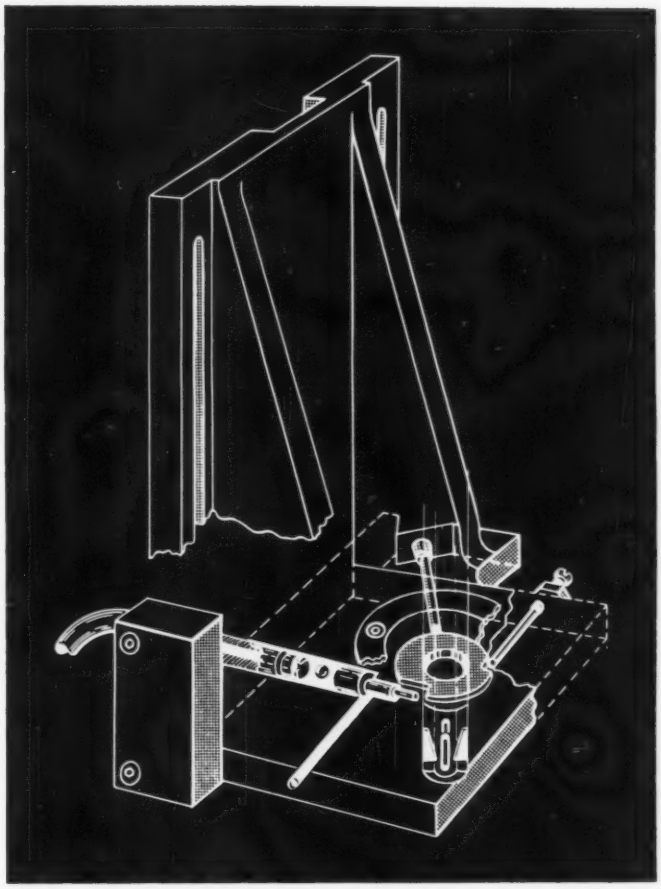
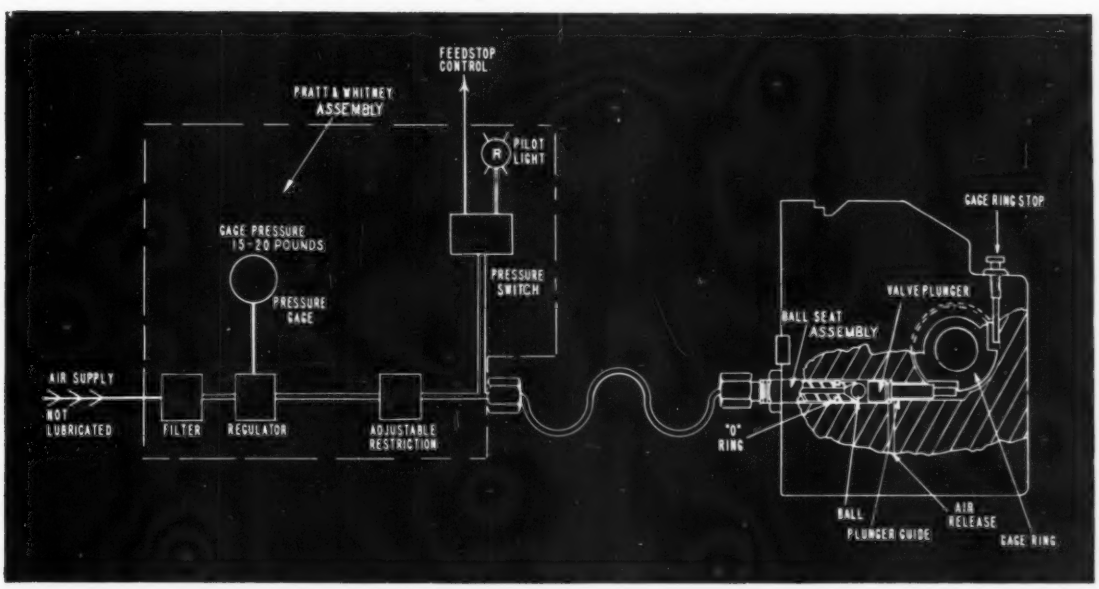


Fig. 2. This gage-ring sizing bracket makes use of the pulse created by the sudden stoppage of a steady air flow to actuate a pressure-sensitive switch. The switch, in turn, provides the differential action necessary to actuate a relay which stops further expansion of the hone.

Fig. 3. Air is filtered and regulated in the air control unit (left) before being led to the gage-ring sizing bracket (right). When the gage ring rotates, it forces the plunger to seat the ball, causing an impulse that actuates the pressure switch. The switch then causes a relay in the feed-stop control (not shown) to halt the hone expansion.



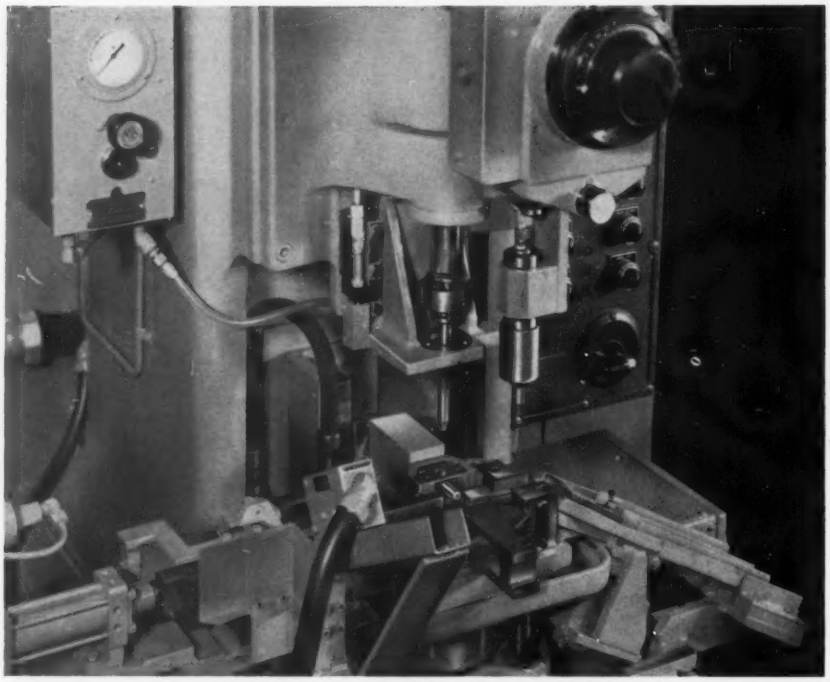


Fig. 4. The air control unit shown schematically at the left in Fig. 3 is mounted on the left-hand side of this honing machine. A flexible air line leads from the unit to the rear of the gage-ring sizing bracket. The honing tool passes through the gage ring.

air circuit and is set to function at a pressure of 10 pounds per square inch.

When the tabs on the ends of the abrasive sticks contact the gage ring, it is forced to rotate with the tool. In doing so, the gage ring contacts the valve plunger and moves it against the air pressure, without altering the flow rate, until the ball is pressed into the seat. The impulse formed at the instant of closure reflects back through the air hose to the pressure switch causing it to operate. Differential action of the pressure switch provides the time necessary to actuate a relay, thus halting the feed-out of the abrasive sticks. Although the ball may be in its seat for as short a time as 0.001 second, the switch may remain in the closed position for as long as 0.100 second.

A certain amount of size adjustment can be obtained by varying the pressure settings at the regulator. Coarse size adjustment is controlled by varying the amount of plunger travel. The purpose of the gage-ring stop illustrated in Fig. 3 is to limit the float of the gage ring. Runout time is obtained by using an electric timer.

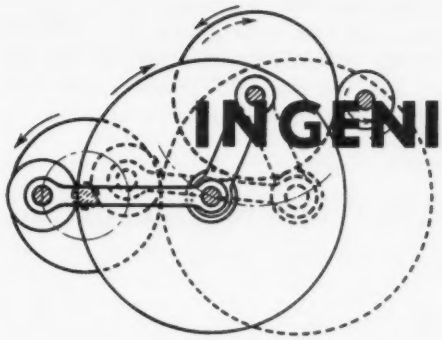
The pressure switch, adjustable restriction, and regulator unit were developed in cooperation with the Pratt & Whitney Co., Inc., West Hartford, Conn. This air control unit, called the "Air-O-Limit" switch, can be seen mounted on the side of a honing machine in Fig. 4 with a flexible air line leading to the rear of the Microsize bracket. In the heading illustration is shown a two-spindle, completely automated honing machine utilizing these units.

New Abrasive Wheel Safety Code Now Available

The revised edition of the *Safety Code for the Use, Care, and Protection of Abrasive Wheels* has been approved by the American Standards Association. Prepared under the sponsorship of the Grinding Wheel Institute and the International Association of Governmental Labor Officials, the new issue has many additions and amendments.

Some of the major improvements over the 1947 edition are the inclusion of information on the popular revolving cap guard and on the fabrication of a drawn steel guard, both for portable grinders. The tables of maximum speeds for grinding wheels have been rearranged and revised. Conditions under which grinding wheels may be run at high speeds have been clarified. Maximum speed values for two new classes of wheels—the reinforced and depressed center types—have been added. In the case of mounted wheels, the critical speed tables have been replaced by those for maximum speeds. The general operating rules also have been expanded. A discussion of steps to be taken by the wheel user after accidental breakage has been added. These are just a few of the changes appearing in the new edition.

Copies of the revised Abrasive Wheel Safety Code may be obtained free of charge by writing to the Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Adjustable Eccentric Produces a Variable Throw

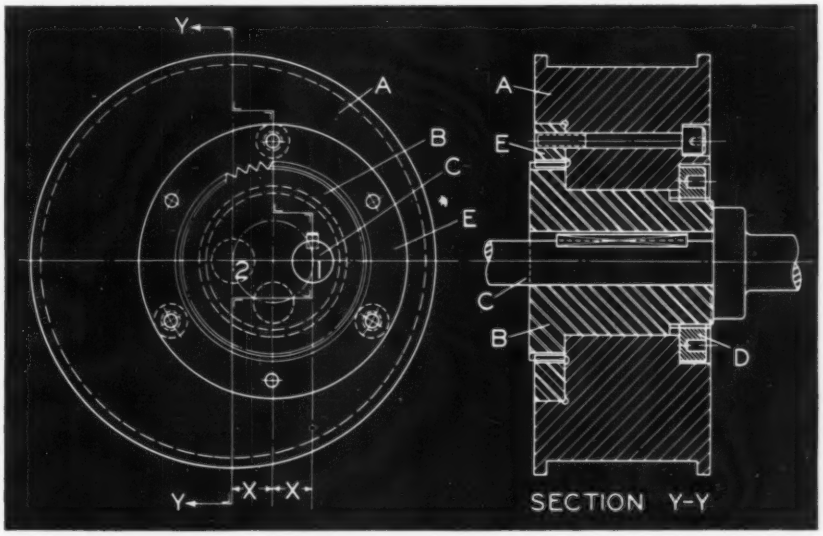
By W. M. HALLIDAY, Southport, England

Rotary movement of a driving shaft must be converted frequently into rectilinear movement for the actuation of such members as slides or levers. One of the most common and effective means for accomplishing this conversion is the combination of an eccentric and connecting-rod. In its conventional form, however, an eccentric is applicable only when a fixed length of stroke is desired. If, on a particular machine, it is necessary to vary the stroke length imparted to the driven members, it is advantageous to employ an adjustable eccentric drive mechanism.

The accompanying illustration shows the design of such an adjustable eccentric. Outer eccentric member *A* is a running fit within the head of a connecting-rod (not shown) which couples the eccentric to the reciprocating machine member. A large hole is bored through the outer eccentric member, being offset distance *X* which is determined by the amount of throw required.

Mounted in the bored hole is flanged sleeve *B*. This sleeve is bored to receive, and is keyed to, drive-shaft *C*. The shaft hole is located eccentrically in the sleeve, the amount of offset provided in the illustrated unit being the same as offset *X*. However, this is not essential, except in cases where stroke lengths are required to vary from standstill to maximum reciprocation. Circular lock-nut *D* is threaded on the right-hand end of the flanged sleeve to retain it in place. Spanner holes are drilled in the face of the lock-nut to facilitate removal and replacement.

The flanged end of sleeve *B* has a series of accurately spaced vee serrations machined on its periphery. The serrations mesh with similar internal serrations provided on ring *E*. Cap-screws and dowels, passing through eccentric member *A* from the opposite side, locate and retain ring *E* in the recess provided. The dowels must be of sufficient size to bear the main driving load.



In this drive, throw of outer eccentric *A* is adjusted by rotating sleeve *B* carrying drive-shaft *C*.

With sleeve *B* situated so that shaft *C* is on the horizontal center line in the position shown at 1, maximum throw of the eccentric is obtained. If lock-nut *D* is backed off, and sleeve *B* is rotated 180 degrees in relation to the outer member, shaft *C* will be coincident with the center of the eccentric, Position 2. At this setting, no motion will be delivered to the machine slide. Sleeve *B* may be located at any intermediate position between the neutral and maximum throw settings.

Mechanism Simultaneously Transfers and Reverses Position of Pad

By W. M. Foster, New Hyde Park, N. Y.

In the processing of paper pads stuffed with excelsior or shredded paper, they have to be transferred a distance of 36 inches between work stations. The pads, which are rectangular in shape, are picked up by a cam-tripped gripper device (not described) along a folded-over bottom edge. During the transfer, the pad has to be reversed so that the leading edge becomes the trailing edge. The diagram, Fig. 1, shows pad positions during the transfer. It will be noted

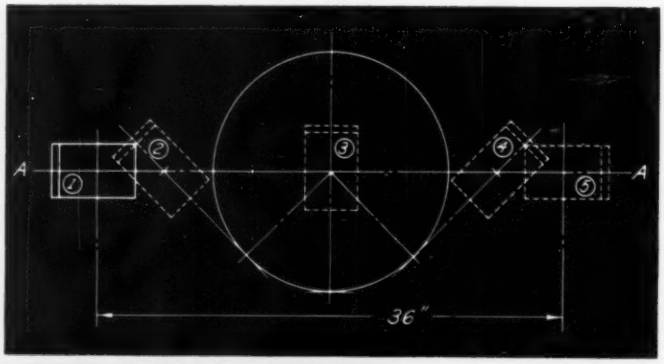


Fig. 1. The transfer mechanism reverses the pad as its center moves along line *A-A*.

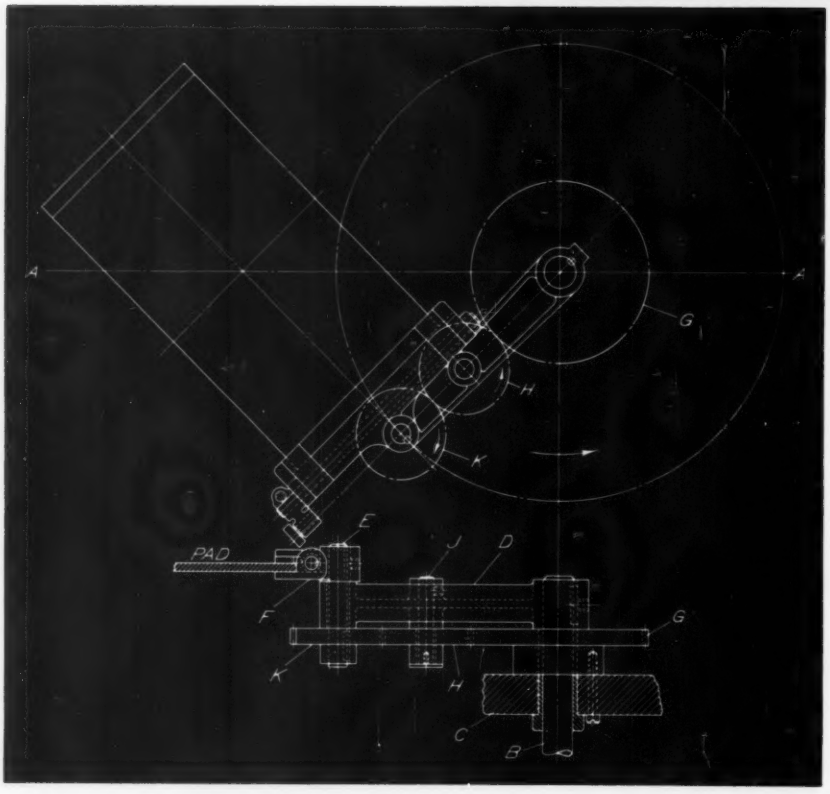


Fig. 2. The counterclockwise movement of lever *D* and the clockwise movement of gear *K* act to reverse the pad in its transfer along line *A-A*.

that the locus of the pad center remains along the line *A-A*.

The transfer mechanism combines simplicity and smooth operation. Drive-shaft *B*, Fig. 2, in frame *C*, rotates at a constant speed of 40 R.P.M., effecting one transfer per cycle. Lever *D*, keyed to the drive-shaft, contains at its other end free pin *E*. The gripper device *F* is keyed to the top of the pin. From the center of the pin, the distances to the center of the pad and the center of the drive-shaft are equal.

For the reversal of the pad during the transfer, three gears are provided: gear *G*, having 192 teeth, is fixed to the frame and free over the drive-shaft; gear *H*, an idler, is free on stud *J* carried by the lever; and gear *K*, having 96 teeth, is keyed to the bottom of pin *E*.

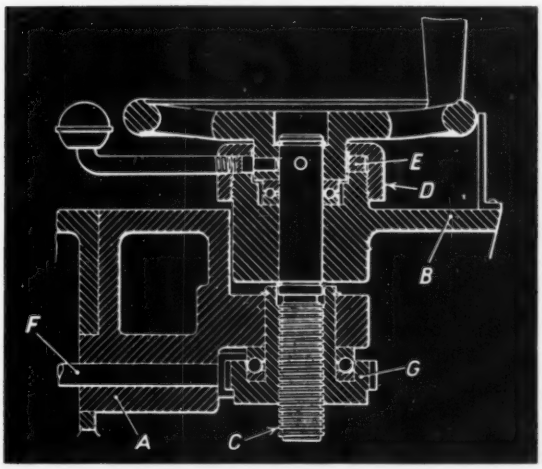
During the cycle, lever *D* rotates counterclockwise at the drive-shaft speed of 40 R.P.M. Simultaneously, gear *K* revolves clockwise on its axis. In 180 degrees of movement of the lever, gear *K* has also moved 180 degrees, but in a reverse direction. The result: the leading edge of the pad in Position 1, Fig. 1, becomes the trailing edge in Position 5.

Fine Feed Arrangement for a Surface Grinder

A patented mechanism by which a fine feed can be given to the wheel-head of a vertical spindle surface grinder is shown in the accompanying illustration. Coarse adjustment of the wheel-head slide *A* in relation to the column *B* is effected by rotation of a handwheel attached to the upper end of screw *C*.

When the fine feed is to be applied, screw *C* is prevented from rotating by tightening the internally threaded cup-shaped member *D* on the threaded boss that is integral with the column *B*. This is accomplished by means of the attached lever. The action causes ring *E*, which is keyed to the handwheel, to be clamped between the face of the boss and the bottom of the bore in cup *D*.

Fine vertical adjustment of the slide *A* is then effected by manual rotation of shaft *F*. A worm attached to this shaft drives a worm-wheel integral with nut *G* which moves along screw *C*.



Tightening threaded cup *D* against ring *E* holds screw *C* in a fixed position. Fine adjustment is then accomplished through the rotation of nut *G* by means of a worm drive on shaft *F*.

° ° °

Steel Capacity at 133.5 Million Tons

The annual steelmaking capacity of the United States has been increased to 133,459,150 net tons during the past year. This, the highest level ever attained, was announced by Benjamin F. Fairless, president of the American Iron and Steel Institute. The new annual figure, stated as of January 1, 1957, represents an increase of 5,096,060 tons over the capacity for ingots and steel for castings reported for 1956. "The American steel industry can now produce more than 40 per cent of the world's output," Mr. Fairless stated.

This additional tonnage will help the iron and steel industry to meet heavy current and prospective demands for new oil tankers, highway construction, schools and public buildings, power plants, and other projects. One year ago the companies announced programs for 1956, 1957, and 1958 that called for increases totaling about 15 million tons—thus, expansion in steelmaking capacity is expected to continue.

° ° °

Reds Score Three Out of Twenty

"When I asked the Russian engineers about their twenty impressive-looking machine tools on display, I found out only three were actually in production and available on the open market. The others were experimental models not in production." So reports Volkert Stampings' (Queens Village, N. Y.) general manager, Jack Kleinoder, after visiting the Russian pavilion at the Zagreb Trade Fair in Yugoslavia. A member of a four-man United States trade mission which recently visited Yugoslavia, Kleinoder debunks popular contentions about Soviet engineering education. While the U.S.S.R. may be turning out engineers at a rapid clip, he claims they are not of the caliber of our engineers.

Dollars for designers!

1st Award	$300
2nd Award	$200
3rd Award	$100
Four additional Awards, each	$50

All accepted entries paid for and published

Enter MACHINERY'S INGENIOUS MECHANISMS Competition

for the best original articles describing mechanical movements

the rules

Both subscribers and non-subscribers are eligible. Entries must be *postmarked no later than August 31, 1957*. Mechanism or movement described must have proved its practicability in actual use. No material already described in the technical press can be entered in the contest.

Enter as many articles as you like, but confine each to a single mechanism or movement.

what you do

Send a scale drawing (or photograph—or both) that shows the operating principle and important parts involved. Clear blueprints or pencil drawings are acceptable, but free-hand sketches cannot be used.

Describe the *purpose* and *action* of the mechanism—*how* it does *what* it does. Your description need not be in polished English, but it should be clear and logical.

Mark details on drawing, such as levers, cams, and gears, with letters *A, B,* etc., and use corresponding letters to identify those details in the description; thus, "Lever *A* is operated by cam *B*." (A suggestion: See how articles in this issue's "Ingenious Mechanisms" section are handled.)

Substitute a diagram for the drawing, if necessary, to illustrate the arrangement of a complicated mechanism.

what we do

MACHINERY'S editors review your entry—thoroughly and objectively—and evaluate it according to its ingenuity and originality. Award-winning articles will be announced in November MACHINERY.

ALL entries accepted will be published in forthcoming issues of the magazine.

And, of course, MACHINERY'S high-level space rates will be paid to ALL CONTESTANTS, in addition to the seven cash awards.

mail your entry to MACHINERY

c/o Contest Editor
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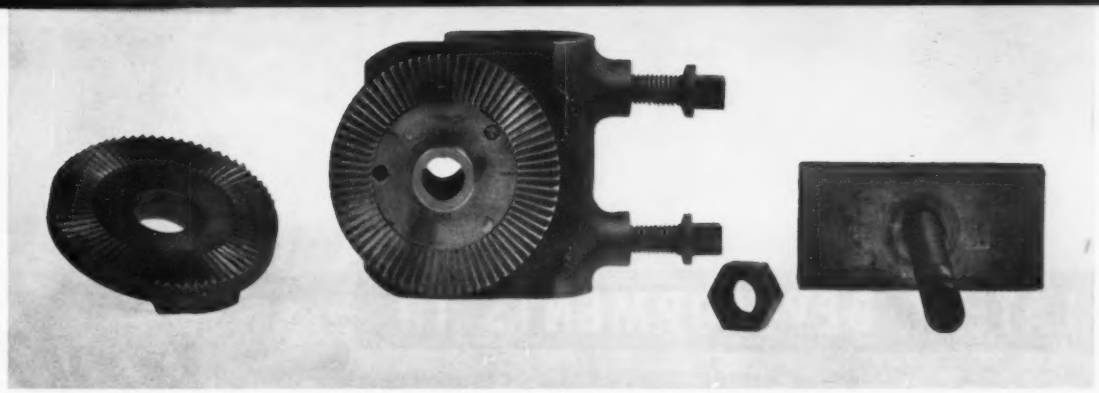


Fig. 1. Lower division plate (left); main body (center); and clamping plate (right) form adjustable boring-bar holder.

Boring-Bar Holder Suitable for Any Compound-Rest Position

By STANLEY P. GOULD, Porterville, Calif.

Boring-bars of various sizes can be accurately located on compound rests at the height of lathe centers by means of the simple shop-built holder here illustrated. The design of this holder is such that the boring-bar can be retained in a position parallel to the lathe bed, regardless of the angle to which the compound rest is set. In taper boring, this facilitates boring long holes, as exceptional clearance is afforded between the shank of the boring-bar and the edge of the hole being bored.

The parts of the holder are seen in Fig. 1 and are shown assembled in Fig. 2. The main holder body *A* has a large 90-degree groove *V* machined along the length of one side to receive the boring-bar. The height to the center of this groove from the bottom of the holder is predetermined to place the center of any boring-bar in line with the center of the lathe spindle when the fixture is assembled on a compound rest. A clamping strap *B*, semicircular in shape, is welded to the holder body lengthwise so as to span this groove.

Two threaded bushings *C* are inserted in holes in strap *B*, central with groove V and welded in place to receive collar screws *D* that lock the boring-bar in place. Bushing *E* is a press fit in the body *A*, at right angles to the V-groove. A circular division plate *F*, which has seventy-two equally spaced teeth on its lower face, is a press fit on bushing *E*. This plate is fastened to the body by dowel-pins *G*. A bottom division plate *H*, which is a close sliding fit on bushing *E*, has teeth similar in shape and number to those in plate *F*. By means of their teeth, the plates can be readily aligned in any desired angular position to compensate for the setting of the compound rest. A tongue *J* extending along the bottom face of plate *H* fits into the neck of the T-slot in the compound rest.

The fixture is clamped on the compound rest by means of plate *K* which is threaded on the lower end of shank *L*. Pressure exerted on body *A*, as nut *M* is tightened, serves to draw plate *K* against the bottom of the T-slot and lock the boring-bar holder in place.

To use the fixture in operations that require a tapered bore, the compound rest is first set to the required angle. Then, by turning the top division plate *F* and the entire upper holder unit a radial distance equal to one tooth for each 5-degree increment that the compound rest is adjusted off the center of the cross-slide, the boring-bar will be retained in a position parallel to the lathe bed.

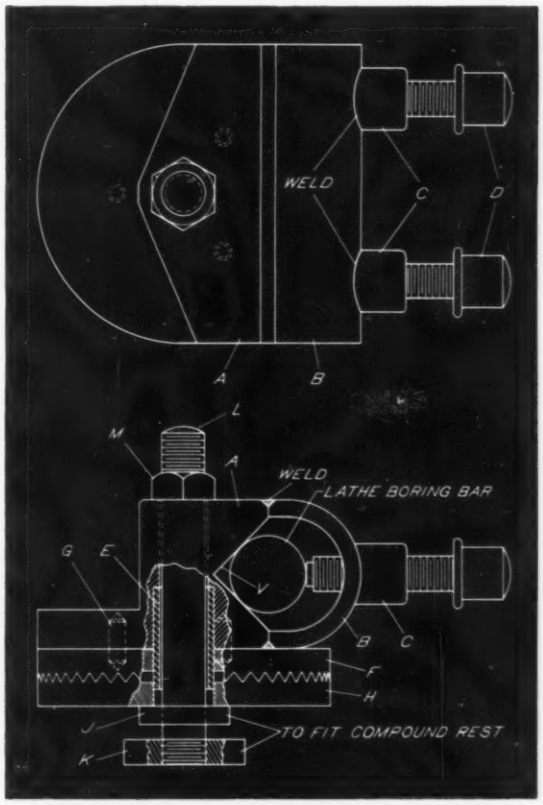


Fig. 2. Diagram of a lathe boring-bar holder designed to hold boring-bars of various sizes parallel with the lathe bed when the compound-rest is set at any 5-degree increments.

LATEST DEVELOPMENTS IN *Shop*

Danly Giant Airfoil Milling Machine

A 150-ton, airfoil milling machine, capable of shaping airplane wings to complex forms or machining the helical blades of an axial flow air compressor, is now in use at the NACA's Ames Aeronautical Laboratory, Moffett Field, Calif. This huge machine—the only one of its kind ever made—was developed and built to the requirements of the Federal Government research center by Danly Machine Specialties, Inc., Chicago, Ill., for scientific research in aeronautics. It is the most advanced development in a series of machines that the National Advisory Committee for Aeronautics has been using for thirty years to produce in metal the airfoil shapes required for research purposes.

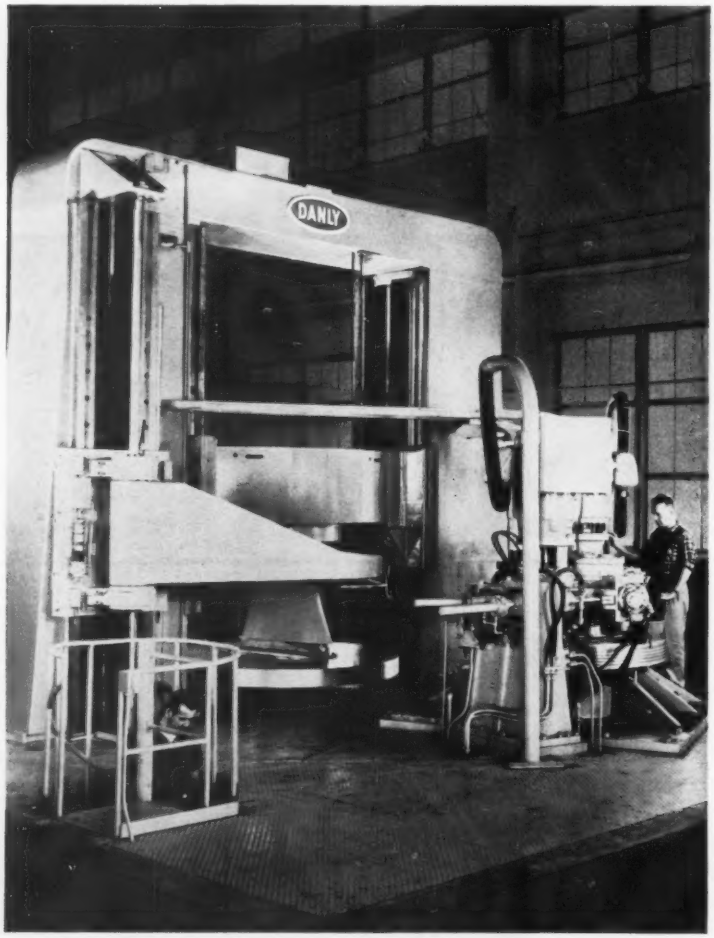


Fig. 1. Above-the-floor view of Danly airfoil milling machine. Between the uprights are shown revolving table, wooden master of complex airfoil shape, and follower wheels.

The products of the new airfoil milling machine and its smaller forerunners have been employed as models for tests in supersonic wind tunnels and as essential parts of the driving machinery of the wind tunnels themselves. The new machine, for example, has been used to mill a series of blades now installed in the main drive compressors of several large wind tunnels at the Ames laboratory.

Airfoil mills are intended primarily for duplicating in metal a complex curved shape generated by tracing a prepared pattern. In the Danly airfoil milling machine a wooden pattern is mounted vertically on a circular revolving table as shown in Fig. 1. Two large tracer wheels are held in contact with the pattern and as the table revolves, the relative motion of the tracer wheels is transmitted to two cutters employed as shown in Fig. 2. The cutters are positioned against the metal blank to be machined, which is also revolved at the same speed as the pattern. In this way, the cutters shape the metal blank to the same curve as the wooden pattern.

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

The shaping action is fully automatic, once the pattern and work-piece have been put in place. Work-pieces up to 18 by 18 by 96 inches long or 8 by 26 by 96 inches long can be shaped on the machine illustrated. The mechanism for holding the metal blank to be machined can exert an upward thrust of 8500 pounds. Both pattern and work-piece on the Danly machine are mounted vertically, in contrast to previous airfoil mills of horizontal design. This mounting method eliminates any bending that might result from the weight of the metal blank being shaped.

Much of the giant machine is hidden from sight in a pit beneath floor level. The sub-floor area is 25 by 25 by 15 feet high and contains a smaller pit 8 feet deep and 6 feet in diameter. The latter pit accommodates the mechanism for the turntable on which the work-piece rides. The machine rises 17 feet above the floor and occupies an area of more than 600 square feet.

Seventeen electric motors are required to operate the new airfoil milling machine. Two motors, each rated at 75 H.P., drive the spindles of the metal-cutting tools which shape the work blank. Other motors turn the table on which the pattern is mounted, provide lubrication, pressurize the complex hydraulic system of the machine, and furnish cooling where necessary. The total motor horsepower is 424. Nearly 80,000 feet of wiring has been used in the machine and its electrical control panel.

The machine has been designed to handle work-pieces of various materials. For cutting alloy steels, a speed range of 78 to 785 feet per minute is available, and for aluminum alloys, speeds between 314 and 3140 feet per minute can be employed. The Danly machine is capable of working to an accuracy of plus or minus 0.004 inch over a 24-inch chordal length and maintaining a good quality of finish.

Circle Item 101 on postcard, page 257

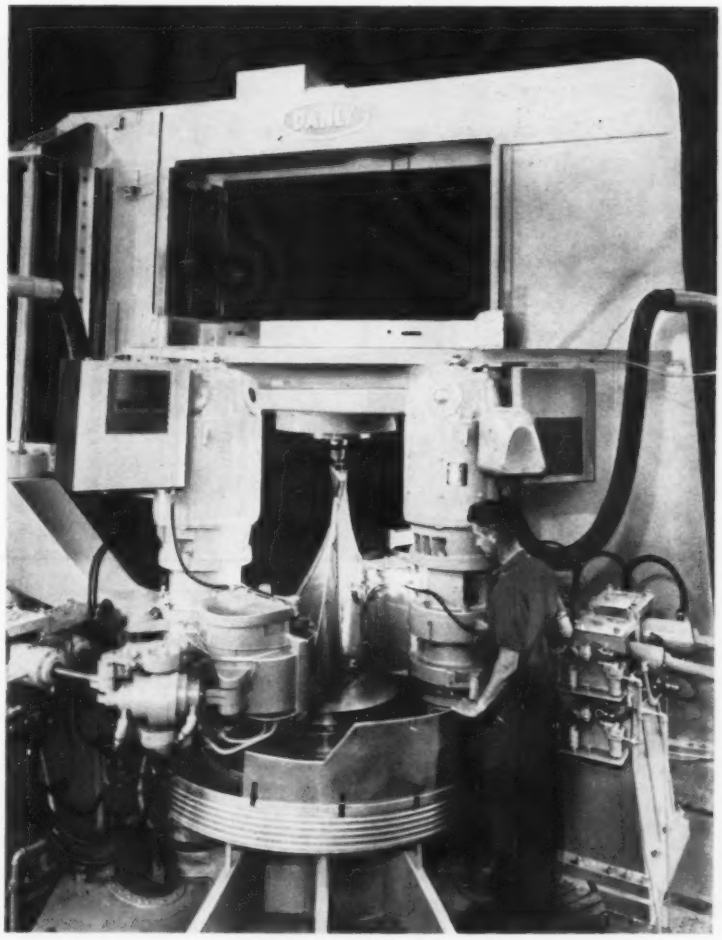
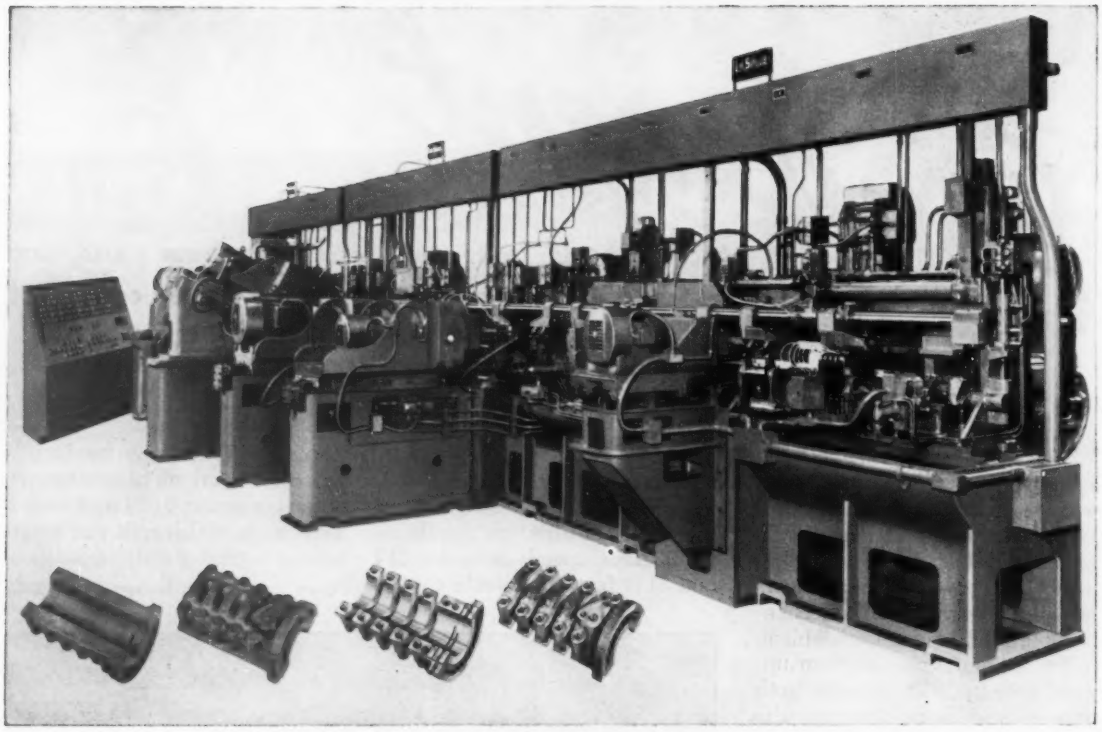


Fig. 2. Close-up view of Danly airfoil milling machine showing two milling cutters in action on an airfoil shape. To the rear of the work-piece may be seen the wooden pattern.



Fully automated twenty-station bearing cap processing machine built by LaSalle Tool, Inc.

LaSalle Twenty-Station Machine for High-Speed Bearing Cap Production

LaSalle Tool, Inc., Detroit, Mich., has announced a fully automated twenty-station machine, called the "Bearing-cap-amatic," which produces a matched set of five finished bearing caps for a V-8 engine from a single casting. This machine handles ninety castings per hour producing 450 finished bearing caps.

The machine is built to JIC hydraulic and electrical standards and has automatic lubrication throughout. A built-in coolant system serves each tool, minimizing tool wear and helping to carry away the chips. An automatic chip conveyor serves as a part of the coolant return system. All milling spindles are adjustable and tool setup points are built into the fixtures. The LaSalle standard way type units of the machine are assembled to allow ample room for both tool changing and maintenance.

The castings handled by this machine are clusters of bearing caps, as shown by the views in the foreground of the illustration. Each casting consists of a cluster of five main bearing caps, and each cap is numbered (5, 4, 3, 2, 1) for easy identification. The joint face, channel fit, and the half-round surface are broached prior to the processing operations. The broached castings are fed into the "Bearing-cap-amatic" automatically by a shuttle type load conveyor, with the joint face down and the No. 5 bearing cap in the lead. They then proceed through all twenty stations automatically.

The bearing-cap cluster is shuttled into the loading station and rotated 90 degrees so that the joint face is in a vertical plane. The part is then shuttled through the machine using one edge of the channel fit for vertical location and the joint face for in and out location.

The main shuttle bar is located above the part and has nineteen shuttle arms that rotate downward 90 degrees to engage the work before it is unclamped. The shuttle arm holds the part against the shuttle rails while it is being moved to the following station. The part is located and clamped in the latter station by the various fixtures. The shuttle bar then rotates the arm 90 degrees upward and returns to original position.

In the nineteenth station, four slots are milled through the bearing cap cluster, dividing it into five separate bearing caps. These five caps are then shuttled to the twentieth, or last, station where they are unloaded.

Circle Item 102 on postcard, page 257

Can-Pro Guards for Machine Tool Ways

Custom-made way guards that expand and contract with the movement of horizontally, vertically, or angularly positioned machine tool slides or tables are being manufactured by the Can-Pro Corporation, Fond du Lac, Wis. These guards embody an exclusive feature which is said to increase tool life. All folds of the guards expand equally and simultaneously.

Each way guard is handmade and is designed to fit and protect a specific member. Special materials,

such as flexible neoprene with its oil and heat-resistant characteristics, are used to afford maximum protection and long life.

Circle Item 103 on postcard, page 257

Hand Feed Surface Grinder

The Harig Mfg. Corporation, Chicago, Ill., has acquired the manufacturing rights for the TML hand feed surface grinder and is producing an improved model of this machine. The new grinder is said to feature greatly improved accuracy and to be easier to operate. It has been redesigned for 100 per cent faster longitudinal travel when the handwheel is operated.

The new design accommodates standard wheel adapters, has a transverse travel of 7 inches, and has a working height under a standard 7-inch diameter wheel of 12 1/4 inches—an increase of 3 inches over former models. Prepacked spindle bearings are said to give longer life, cleaner operation, and greater accuracy. Power is supplied by either a 1/2- or 3/4-H.P. motor. The machine is available without the cabinet for use as a bench model. Total machine weight of the cabinet model including motor is 550 pounds.

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Cleveland Two-Point Double-Geared Press

A two-point, double-geared press equipped with a patented drum type air friction clutch, with a combination clutch and motor control, is announced by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. An automation control for auxiliary feeding devices and additional 110- and 140-volt receptacles are provided.

The slide is counterbalanced by air and is arranged for power adjustment by means of a separate high torque motor having a magnetic brake. The press is furnished with safety blocks chained to disconnect plugs which, when pulled, break all of the control circuits. A recirculating oil system is incorporated in the press. The die space is illuminated from both sides by lights in the uprights.

The slide has a stroke of 12 inches and an adjustment of 12 inches. The shut height is 38 inches; the bed and slide area, 36 by 60 inches; and the operating speed, 30 R.P.M. Rated capacity is 500 tons.

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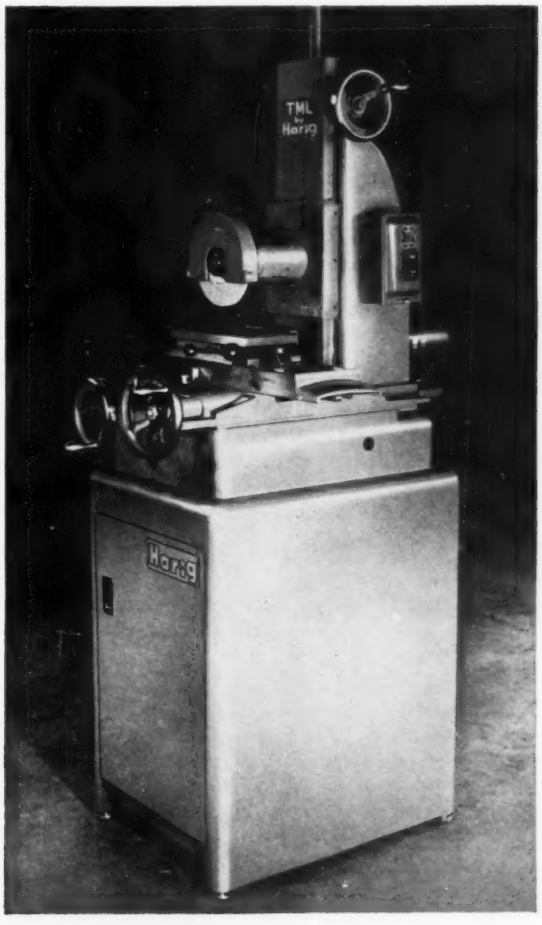
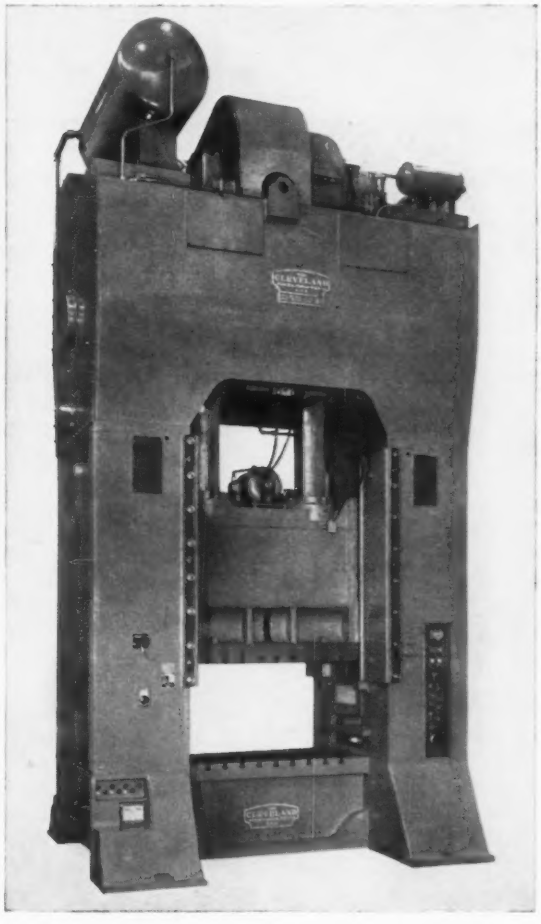
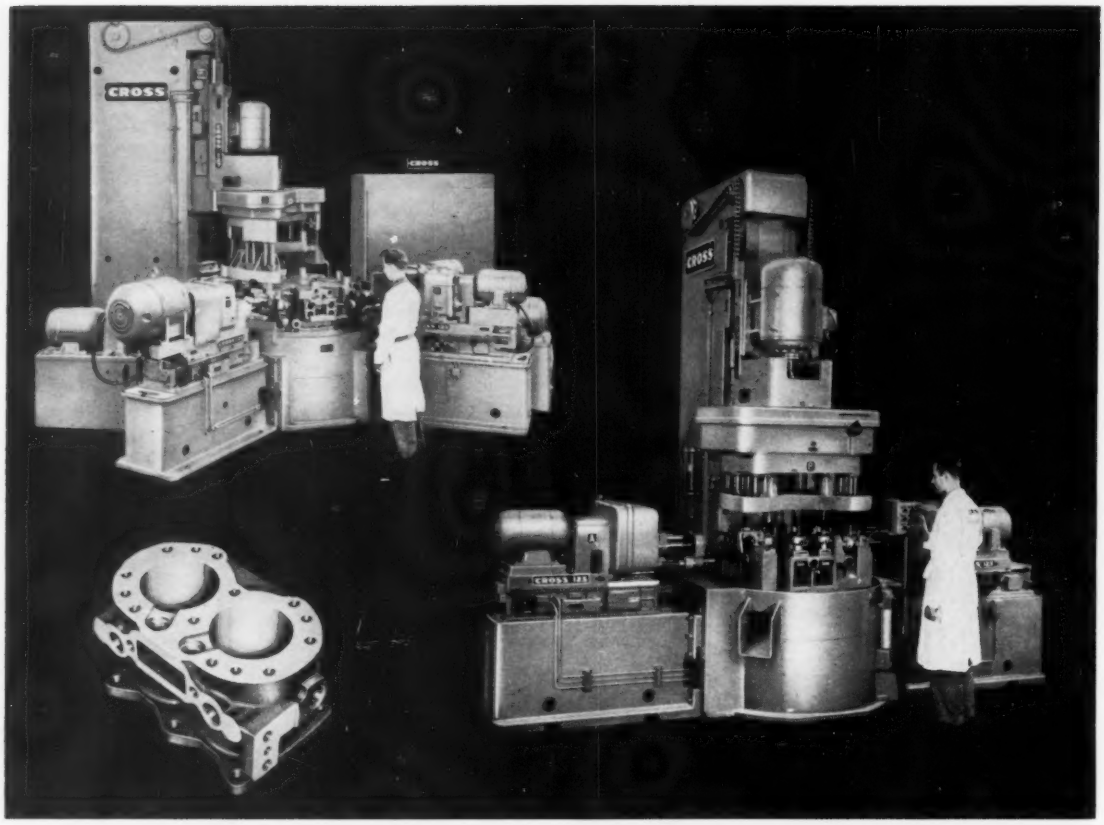


Cabinet model TML hand feed surface grinder built by the Harig Mfg. Corporation



Two-point, double-geared press announced by the Cleveland Punch & Shear Works Co.



Two dial type production machines brought out by The Cross Company

Cross Dial Type Machines for Processing Air Compressor Cylinder Blocks

A pair of dial type machines arranged to process six different air compressor cylinder blocks have been announced by The Cross Company, Detroit, Mich. These two machines rough- and semifinish-bore the cylinders; rough- and finish-counterbore the valve ports; and drill, chamfer, and ream all other necessary holes. The top, bottom, and sides of the cylinder blocks are milled in preparation for processing on these machines.

The first machine is equipped with a four-station index-table, and the second machine with a six-station index-table. Indexing is automatic and is fully interlocked with the machine cycle. Both machines are equipped with two-position, progressive work-holding fixtures having interchangeable adapters for the six different parts. The production capacity of the two machines is 129 cylinder blocks per hour, at 100 per cent efficiency.

Complete interchangeability of parts, even to tooling details, provides for fast, easy maintenance, reduced down time, and flexibility in handling parts that undergo frequent design changes. Construction is to JIC standards. Other features include hydraulic feed, rapid traverse, and hardened and ground ways.

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Everite Electrochemical Machine for Sharpening and Shaping Carbide Tools

Sharpening and shaping of carbide tools by electrochemical dissolution—a process known as "electrolytic grinding" or "electrolytically assisted diamond wheel grinding"—can be accomplished with a machine tool specifically designed for this process by the Everite Machine Products Co., Philadelphia, Pa. This new equipment, called "Electrochemical Machine Tool H-1," is a complete unit designed to handle corrosive electrolytes and is capable of performing electrolysis without additional equipment. The direct-current unit is a part of the machine.

The principle on which the machine operates is based on anodic dissolution. In the machining process, a tool which is made anodic (+) is brought into contact with a rotating wheel, the cathode (−), as illustrated diagrammatically in Fig. 2. An electrolyte is used to pass the current between the anode and cathode, thus completing the circuit which causes metal to dissolve at the anode. The material normally formed at the anode is wiped away by rotational action of the cathode. The result is controlled metal removal by electrochemical dissolution.

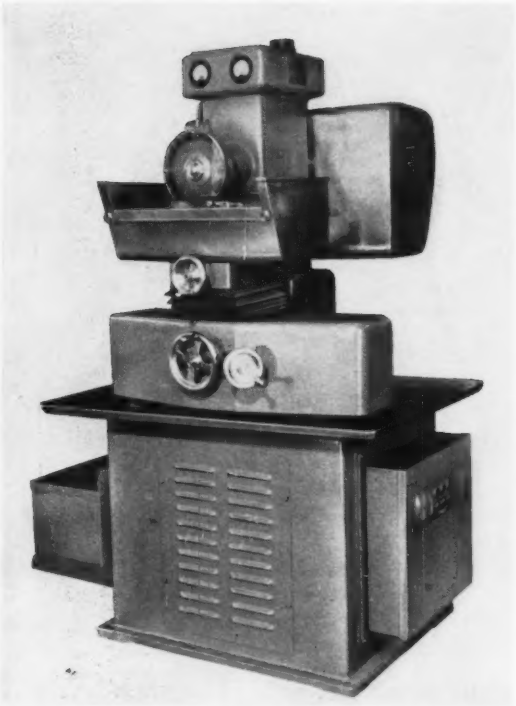
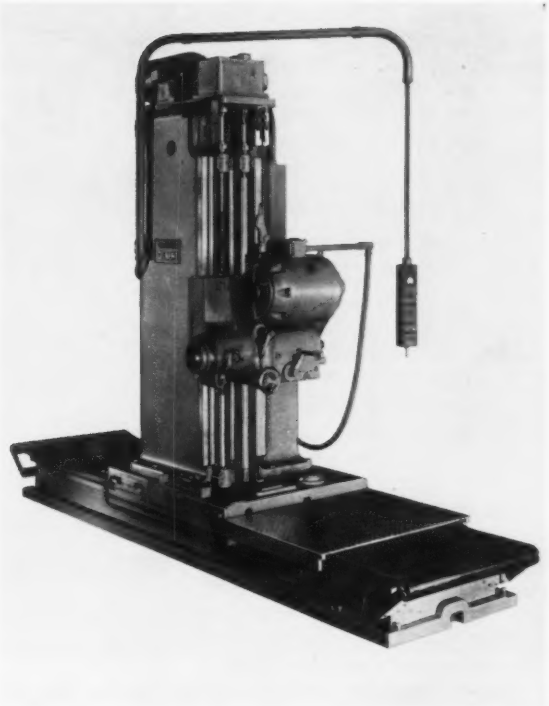


Fig. 1. Electrochemical machine for sharpening carbide tools built by Everite Machine Products Co.



Floor type milling machine developed by the Cincinnati Gilbert Machine Tool Co.

For most applications, a metal-bonded diamond wheel is suitable as a cathode. The anode (tool to be sharpened) is held in contact with the rotating diamond wheel with just sufficient pressure to maintain contact. The anode-cathode interface has a gap distance of very small magnitude, and currents of very high densities are obtained at low voltages. The primary function of the diamonds in the wheel is to wipe away any insoluble anode reaction products from the work-piece. Only one wheel is required for the finest finish (about 5 to 8 micro-inches).

Circle Item 107 on postcard, page 257

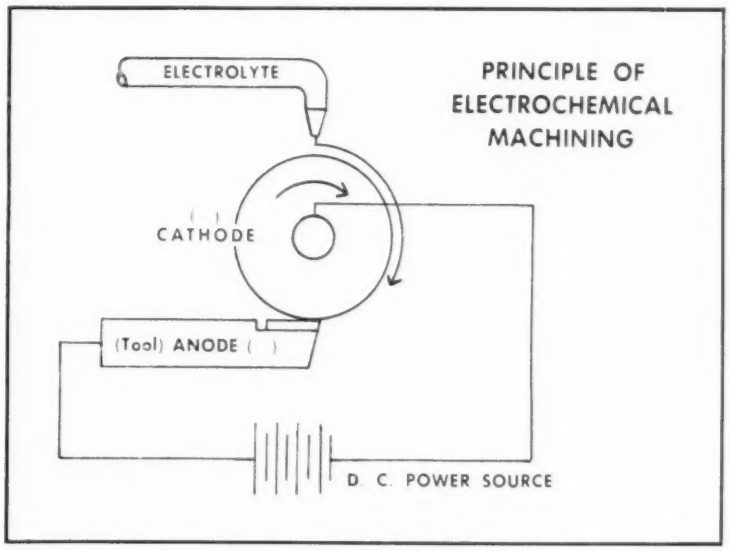


Fig. 2. Diagram illustrating operating principle of machine shown in Fig. 1.

Gilbert Floor Type Milling Machine

A pendant-controlled milling machine has been developed by the Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio, for milling the ends of structural steel shapes. The wide range of horizontal and vertical travels available on this machine makes it well adapted for many other cumbersome milling jobs. The vertical travel of the spindle head is 36, 48, or 60 inches; horizontal travel of the column, 48, 72, 96, or 120 inches; and height of runway, 14 inches.

A pendant station controls the 20-H.P. main drive motor and the multi-speed feed motors. A horsepower meter is mounted on the pendant. Adjustment of the spindle is by means of a handwheel, equipped with a dial reading to 0.001 inch. Spindle speeds are 400, 972, and 1620 R.P.M. Feeds to the head and column are 30, 40, and 60 inches per minute. Taper in the spindle nose is No. 50 NMTBA Standard equipped with draw-bar.

In actual operation, the machine

takes smooth, straight cuts at a surface speed of about 1000 feet per minute and a feed of 60 inches per minute, using throw-away type carbide cutters.

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Westbury Toolroom Lathe

The Maserati Corporation of America, Westbury, N. Y., has introduced in this country the Westbury 12-32 toolroom lathe which is being made in Italy. This lathe has a swing of 12 inches over the bed, a swing in the gap of 17 3/4 inches, and a distance of 32 inches between centers.

The cast-iron bed is reinforced by latticed ribs and has ample provision for chip discharge. The front spindle bearing is of bronze and has adjusting wedges. The rear spindle bearing is a combination radial and thrust ball type.

An anti-loosening safety device is provided for the spindle nose, and there is a foot brake for fast stopping. Hardened and ground gears in the headstock run in an oil bath. Spindle speed can be changed while the machine is running. A V-belt drive transmits power from the motor to spindle. Automatic release of the longitudinal traverse is obtained by a pre-set positive-stop dog, and a Norton gear-box is optional equipment.

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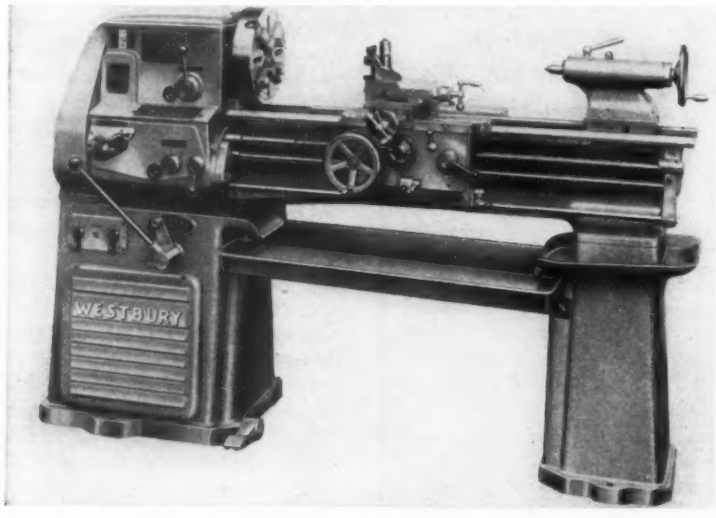
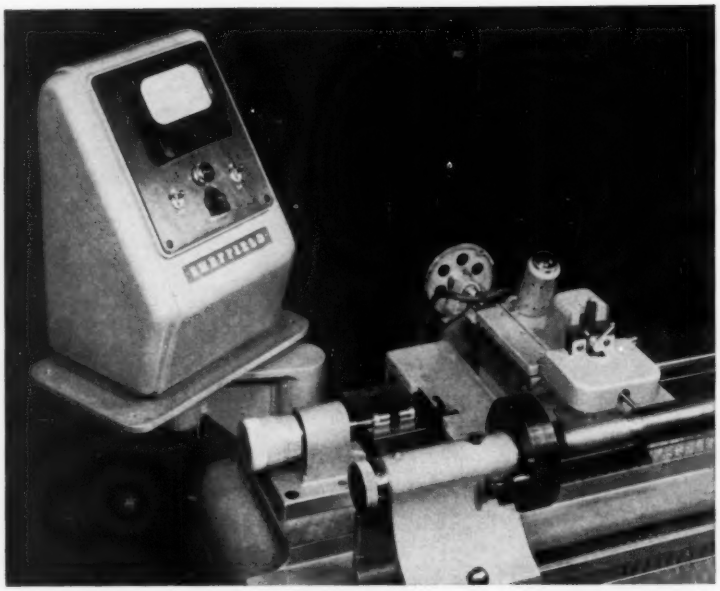


Toolroom lathe introduced by the Maserati Corporation of America



Close-up of high amplification electronic "Leadchek" announced by the Sheffield Corporation

High Amplification Electronic "Leadchek"

A new model electronic "Leadchek" for measuring the lead of lead-screws is being manufactured by the Sheffield Corporation, Dayton, Ohio. The instrument can be used to detect lead errors in straight or tapered work and rack teeth. It is available with electronic amplification ratios of either 1000/2000 or 2500/5000 to 1. Amplification within each dual range can be switched from one to the other without realignment of the indicating meter mechanism. When an amplification of 5000 to 1 is employed, direct readings on the zero center equilinear scale can be made to ten millionths (0.00001 inch).

The electronic "Leadchek" will handle work up to 36 inches long and 10 inches in diameter with standard tailstocks. Used with a V-block accessory, any length work with diameters from 1/2 inch to 6 inches can be checked. The instrument is approximately 59 inches long, 24 inches wide, and 51 inches high. Electronically, it consists of a Sheffield "Electrojet" transducer type gage cartridge connected to a remote Sheffield "Accutron" amplifier.

The "Electrojet" is located in the gaging unit and is actuated by the ball point gaging stylus that contacts the flank of the thread. Indicator response is instantaneous and readings are consistently repetitive. The amplifier is unaffected by line voltage fluctuation from 65 to 150 volts and operates on 110-volt 60-cycle alternating current. The "Accutron" amplifier can be provided with an optional outlet for connecting a meter reading recorder or other accessory equipment.

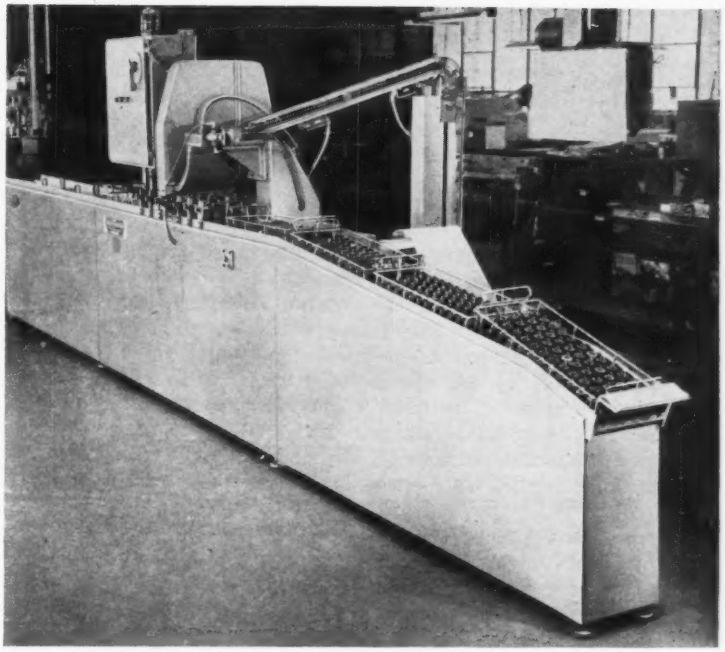
Circle Item 110 on postcard, page 257

Equipment for High-Speed "Basketing" of Parts

A high-speed method for automatic "basketing" of parts prior to, during, or after processing which is said to effectively boost the efficiency of automated production lines has been developed by the Gear-O-Mation Division, Michigan Tool Co., Detroit, Mich. This new method is being used to basket small center-bored pinions, up to 1 1/8-inch pitch diameter, at a loading rate of 3000 pieces per hour, as they come from a Michigan Electro-Audio Tester. Although each basketing unit is custom-tailored to a specific job, it is assembled from standard components and can be adapted to most part-loading operations.

Parts are fed to a dropping mechanism through an enclosed track using chain lifts and gravity flow. The rate of feed is variable through standard interlocked limit switches—with all handling, even at high speed, gentle enough to prevent marring the work.

As they leave the incoming track, the rolling parts are guided and tipped through a curved channeled fixture and held positively at the bottom end. Release into baskets is from this point and is actuated by automatic indexing of the basket. The parts are dropped onto upright basket prongs a row at a time.

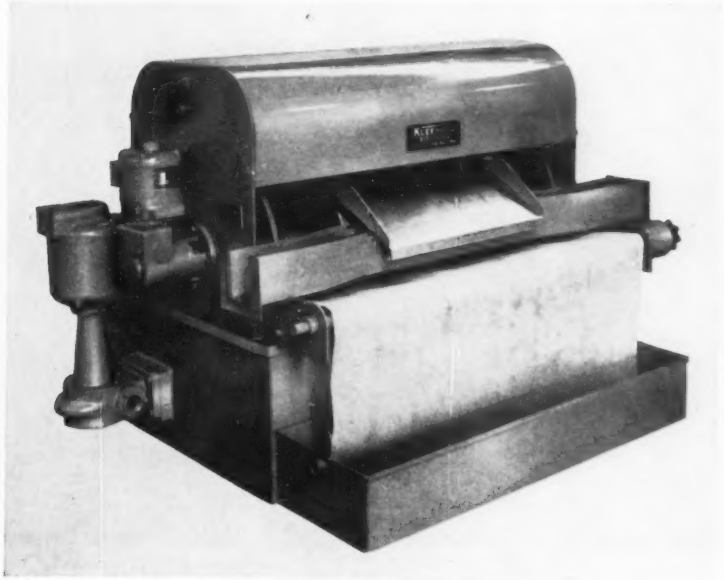


Equipment for high-speed automatic basketing of parts, developed by the Gear-O-Mation Division, Michigan Tool Co.

Empty baskets enter the unit on a chain conveyor and are horizontally positioned by spring clips. Before passing beneath the "drop," vertical positioning of the basket is effected by locked roller guides. Indexing of the basket is accomplished by limit switches triggered by the chain drive.

As each row of prongs in the basket is loaded, the next row of prongs is automatically indexed into place. The indexing arrangement is self-controlling, the end of the run or a malfunction serving to stop the equipment.

Circle Item 111 on postcard, page 257



Barnesdril Kleenall filter of improved design

Kleenall Filter for Coolants

The Barnes Drill Co., Rockford, Ill., is manufacturing an improved filter designed for filtering coolants that require the removal of foreign particles. This filter, known as the "Barnesdril Kleenall," has been developed to achieve maximum efficiency and ease of maintenance. The intake distributor has been changed from a pipe to a trough type to facilitate removal of sludge dropout and foreign material formerly trapped in the pipe.

Other changes include placing of the drive on the front idler shaft, use of larger seal wheels to provide greater area for sludge buildup, larger motor on the larger models, improved clutch design, and heavier conveyor belt.

Circle Item 112 on postcard, page 257

H-P-M 1000-Ton Hydraulic Press

A huge, 1000-ton hydraulic press has been built by the Hydraulic Press Mfg. Co., a Division of Koehring Co., Mount Gilead, Ohio, for hot-piercing high-explosive, 8-inch shells. This press performs the first operation in the hot-forging, cold-extrusion process used in shell manufacture. It has a bed 66 by 60 inches; daylight capacity of 98 inches; stroke length of 60 inches; and is equipped with a 150-ton hydraulic ejector which has a 24-inch stroke. The main ram has a closing and return speed of 1000 inches per minute and a pressing speed of 600 inches per minute.

The press is equipped with a pressure vessel (shown at right in the illustration) of sufficient capacity to perform a high-speed pressure stroke of 19 inches. Operation of the H-P-M power system requires 530 H.P.

In using the hot-forging, cold-extrusion process in the manufacture of shells, hot-piercing eliminates the need for a very heavy press that would be necessary for the initial operation in the normal cold-extrusion process. Following the hot-pierce, the same methods are used as in the cold-extrusion process, thereby effecting the same economies in the grade of steel required and the elimination of machining operations. This is one of five presses of different types and tonnage capacities required for the production of shells by the hot-forging, cold-extrusion process.

Circle Item 113 on postcard, page 257

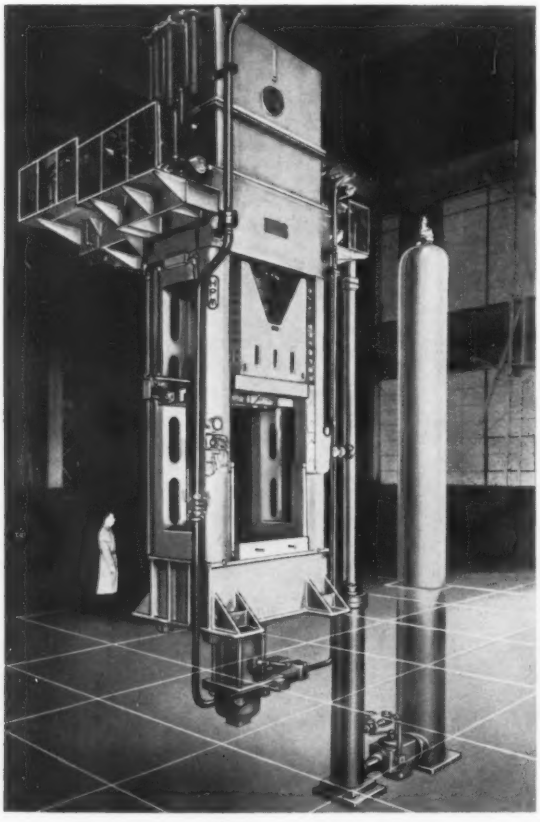
Precision Surface Grinder

The Reid Brothers Co., Inc., Beverly, Mass., recently introduced a complete line of Reid 618 precision surface grinders. Three models will be available: the 618P with power table and cross-slide feeds; the 618PT with power table and hand-operated cross-feed; and the 618H arranged for full hand-feed operation.

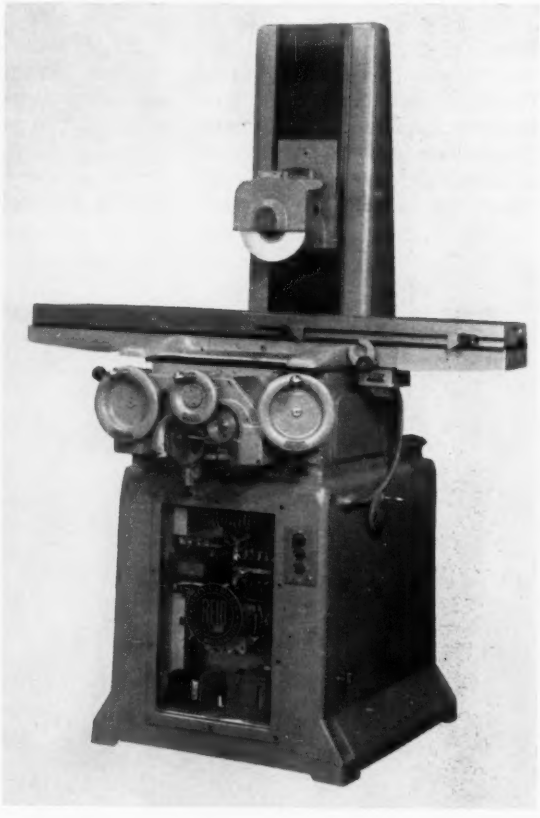
The reciprocating table is driven by a cogged timing belt that provides a positive non-slip drive which is said to eliminate "chain chord marks" on finished work-pieces. A newly designed cross-feed operates within 1 1/2 inches of the end of the stroke in both directions, resulting in a better finish. Cross-feed is adjustable from 0.006 to 0.100 inch.

Elevation of the self-contained motorized grinding spindle is facilitated by the addition of ball bearings to the elevating shaft. Both the table motor and spindle motor have overload protection. A feature of all models is the low-pressure automatic lubrication system which maintains constant lubrication protection of all moving parts while the grinder is in operation. The grinder occupies a floor space 71 by 43 1/2 inches.

Circle Item 114 on postcard, page 257



H-P-M hydraulic press designed for hot-piercing high-explosive shell forgings



Precision surface grinder recently introduced by Reid Brothers Co., Inc.

High-Capacity Storage and Feeding Unit for Ring-Gear Blanks

A radically new, high-capacity storage unit for ring-gear blanks or other parts that will roll by gravity through circular tracks in automated processing lines has been developed by the Gear-O-Mation Division, Michigan Tool Co., Detroit, Mich. The rotary unit is designed to offer a true demand-feeding system from a controlled, mobile storage medium. As shown in the illustration, the unit is used to store and feed ring-gear blanks for a broaching operation. This pneumatically operated installation has a capacity for handling over 300 work-pieces.

Each storage unit is custom-tailored to a specific job and assembled from standard components. The rotary form is provided in either circular or oval-like shape to suit floor space requirements. All work handling, even at high speed, is gentle enough to assure delivery of unmarred parts.

As the parts leave the elevator at top of the equipment, they are gravity rolled through the circular tracks to the exit chute takeoff. The parts can be positioned vertically or horizontally for the processing operation. Air-cylinder-operated gates in the tracks control movement of the parts on demand.

When used for stockpiling of parts, the equipment automatically stops when full capacity has been reached. This is accomplished by using the static weight of parts to mechanically move air valves which cause the gates to open or close.

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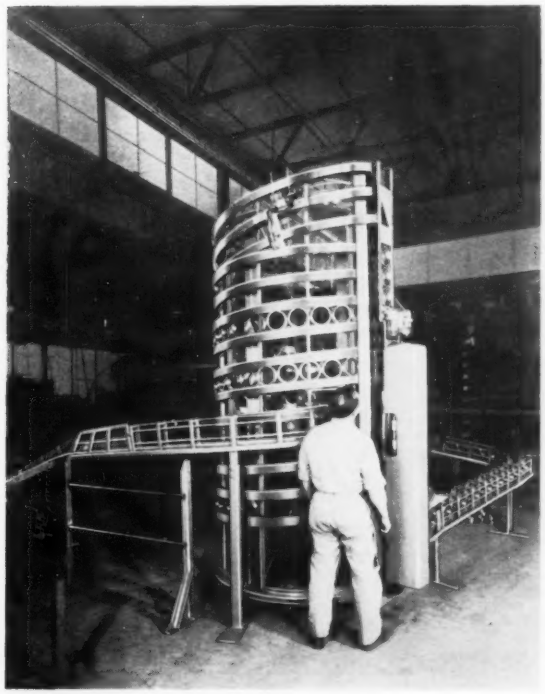
Grotnes Expander with High Draw-Bar Pull

The Grotnes Machine Works, Inc., Chicago, Ill., has announced a No. 15-H-215 expander having a peak draw-bar pull of 215 tons at the maximum hydraulic system pressure of 3000 pounds per square inch. This machine is the first of a new "H" series with draw-bar pull capacities ranging from 60 to 1450 tons. Advanced design of this series incorporates extreme flexibility as to range of shapes and sizes of parts that can be handled in one basic machine by interchanging the draw-bar, cone, jaws, and table.

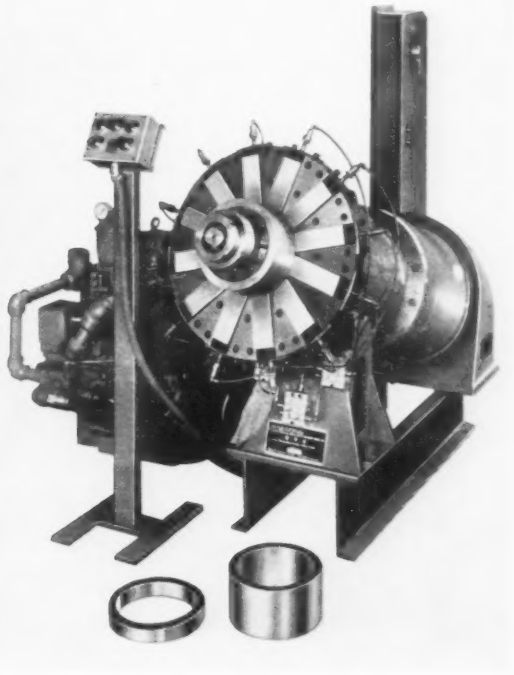
These expanders find their principal application in the accurate forming and sizing of cylindrical, conical, and polygonal sheet metal and tubular parts, such as automatic washer spinner tubs, various metal containers, pipe couplings, water and air tanks, and particularly rocket, missile, and jet-engine components in both sheet metal and heavy-ring categories.

A duplex type variable-delivery pump, reservoir, oil cooler, piping, and valves comprise the hydraulic system which is capable of operating the machine at from 2 to 6 complete cycles per minute. The unit shown has a speed of approximately 2 cycles per minute. Regardless of over-all cycle time, the expanding rate can be varied by means of a pilot-motor-operated adjustment. This is very important when handling some types of metals and when the amount of expansion required is high.

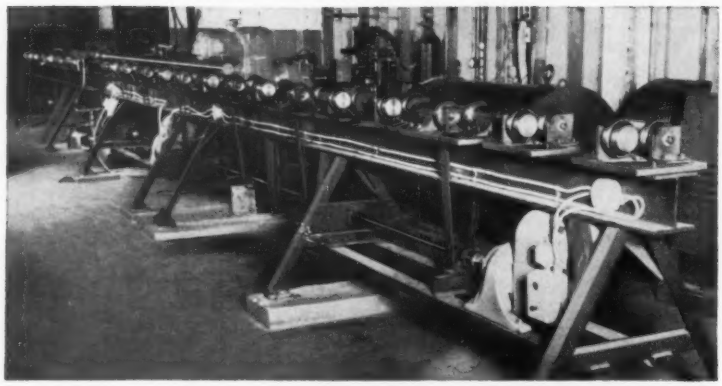
Circle Item 116 on postcard, page 257



Rotary storage and feeding unit for ring-gear blanks developed by Michigan Tool Co.



Expander having a heavy draw-bar pull brought out by the Grotnes Machine Works, Inc.



"Thermatool" rod-hardening mill built by New Rochelle Tool Corporation

"Thermatool" Progressive Rod-Hardening Mill

Uniform hardening of mill length shafting to a specified depth and hardness is achieved in continuous production with push-button simplicity on the "Thermatool" progressive rod-hardening mill designed and built by the New Rochelle Tool Corporation, New Rochelle, N. Y. This equipment is intended for use in metal-working shops for hardening carbon steel rods up to 4 inches in diameter and 30 feet or more in length. Hardness is accomplished without distortion so that the usual straightening operation is eliminated.

The "Thermatool" mill has an arrangement of skewed rolls driven by two 1-H.P., variable-speed motors. Feed rate and rotational speed of the rods can be adjusted independently of each other. The depth and degree of hardness obtained in the steel rods is determined by the feeding and rotating speeds, plus the amount of power expended.

The steel rod is subjected to continuous hardening as it passes through the induction coil of the hardening mill. The heating coil is energized by a 50-k.w., 9600-cycle motor-generator. A drum-shaped unit fed by a water pipe provides the quenching spray for the hardening operation.

Production rates vary according to rod diameter, hardness, depth of hardness, and amount of power used. For example, hardening rods to Rockwell C 60+ for a depth of 0.060 to 0.250 inch is accomplished at the rate of 50 inches per minute in the case of rods 1/2 inch in diameter, and 3 inches per minute for rods 4 inches in diameter.

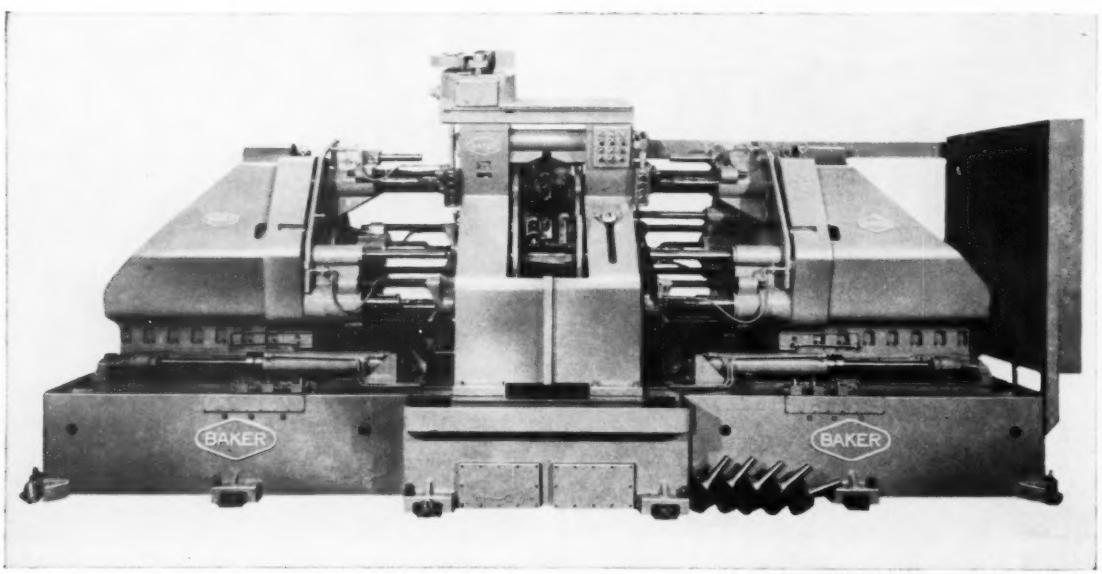
Circle Item 117 on postcard, page 257

Five-Station Machine for Processing Steering Knuckles

A five-station, trunnion type machine designed to process forged steering knuckles at the rate of fifty-two per hour has been announced by Baker Brothers, Inc., Toledo, Ohio. This machine performs core-drilling and reaming in a completely automatic cycle.

The full reduction heads of this machine are specially built—with 15-H.P. bevel gear drive, mounted on Baker Basic Model 1830 standard slides—and utilize standard tooling. The basic equipment consists of flexible automation units that can be used in combination as a transfer machine, or employed separately.

Drive units travel on flame-hardened bar slides. Twin-pull cylinders for the feed are located on the outside of the slide where



Trunnion type machine for processing steering knuckles announced by Baker Brothers, Inc.

they are easily accessible for servicing. Hydraulic power is supplied by a separate Baker "Porta-Pak." The machine has a centralized, automatic lubrication system.

Circle Item 118 on postcard, page 257

Thiel Facing Machine for Finishing Flat Surfaces

A machine designed to produce flat and square surfaces on any work-piece is announced by the Eastown Tool & Engineering Co., East Detroit, Mich. This Thiel facing machine has a 14-inch cup-shaped grinding wheel mounted perpendicularly to the table. Only one flat surface of the work-piece need be held to the table. Unique squaring and clamping blocks, sliding in table keyways, hold the work rigidly in the squaring position. Operating at 1400 R.P.M., the grinding wheel faces cold- or hot-rolled steel, tool steels, steel castings, and non-ferrous alloys.

This facing machine is being used extensively to prepare stock for layouts, and to size die sections and fixture components. When considerable stock removal is required, one of two progressive-cutting face mills may be substituted for the grinding wheel. A twelve-blade milling cutter 6 inches in diameter is used for ferrous alloys, and will remove up to 1/4 inch of stock in a single pass. An eighteen-blade cutter 12 inches in diameter is used for non-ferrous metals and will make a 3/8-inch cut in one pass. Special gripping fixtures for holding non-ferrous plate, and magnetic chucks for holding thin ferrous pieces are also available.

Circle Item 119 on postcard, page 257

Boring Head and Boring-Bar with Kennametal Button Inserts

For boring engine cylinders with all of the advantages obtainable from carbide cutting edges, a special Kendex boring head has been developed by Kennametal Inc., Latrobe, Pa. Economical use of Kennametal was made by utilizing four 1/2-inch square turnover button inserts which have eight indexable cutting edges per insert. Kennametal shims assure positive insert seating. Boring heads of this type for engine cylinders of any size and with four or more cutters can now be built to specifications.

Boring-bars using Kendex triangular button inserts are also being introduced by Kennametal in sizes having shank diameters ranging from 1 1/2 to 2 1/2 inches.

Kennametal Kendex boring head using button inserts

These new tools offer the advantages of hard carbide cutting edges with the economy of small buttons which can be indexed and turned in seconds to give six cutting edges.

Circle Item 120 on postcard, page 257

Console Model Automatic Hardness Tester

Up to one thousand Rockwell hardness tests can be automatically classified per hour by hand-feeding individual pieces to a Size 3 console model fully automatic hardness tester perfected by the Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc., Bridgeport,

Thiel facing machine for finishing flat surfaces on large variety of work-pieces announced by the Eastown Tool & Engineering Co.

Automatic hardness tester and classifier introduced by the Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc.

Conn. This tester operates basically on the same principle as the manufacturers' hand-actuated units. It will test any metal on the regular Rockwell A, B, C, D, E, F, G, H, and K scales and will automatically separate tested work-pieces into one of three categories —correct, too hard, or too soft.

Work-pieces may be tested in one of two ways: manual feed and manual disposal or semi-automatic, with manual loading and automatic disposal and classification as to hardness. By making a simple change of plunger extensions, the unit can be set up to test materials within a thickness range of from 0.030 inch to 6 inches.

Single tests may be performed by merely snapping a switch which changes the cycle from continuous to single operation. With hand-fed operation for individual testing, control of the unit is through a push-button or a foot-switch. As each piece is tested, one of three lights on the tester will indicate the hardness classification.

Circle Item 121 on postcard, page 257

Campbell Storage Feeder for Heavy Parts

The Campbell Machines Co., Detroit, Mich., has developed an automatic storage feed hopper for large, heavy parts and bar shapes. Part sizes may range up to a 3-inch square bar, with lengths up to 16 inches. Hopper capacity is 35 cubic feet or 15,000 pounds.

This feed hopper will automatically orient and feed bar shapes and parts from its large storage bin to furnaces, presses, secondary operation machines, and washing machines at production rates of 1000 pieces per hour. This controlled flow of oriented parts is automatically fed to processing equipment without operator assistance.

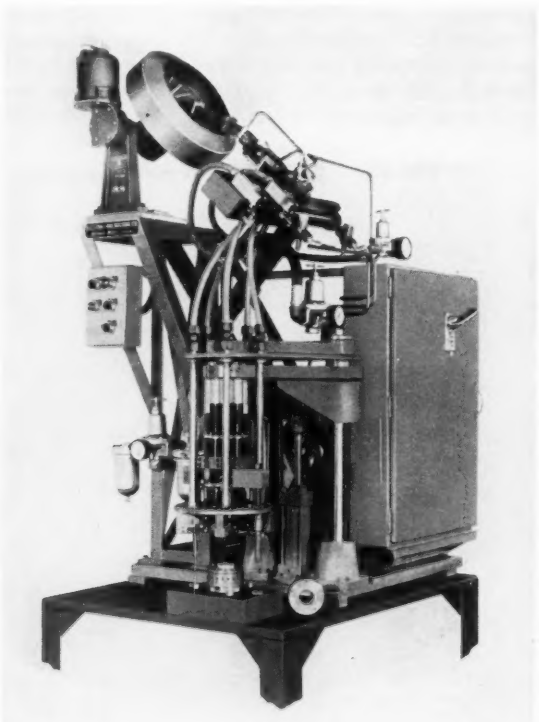
The storage feed hopper illustrated feeds 1 3/4-inch diameter by 8-inch long heavy wall tubes to a finish machining line at the rate of 360 tubes per hour. The storage bin holds enough tubes for eight hours of continuous production. These tubes are delivered from the storage bin to the short feed tray at the right of the machine. The flow of tubes from the storage bin is controlled electrically by the number of tubes at the feed tray. The processing machines are fed directly from the feed tray.

Circle Item 122 on postcard, page 257

Automatic Multiple Screwdriver with Precision Torque Control

A multiple screwdriver designed to automatically feed and drive five screws in a transmission stator has been brought out by the D & L Tool & Machine Co., Detroit, Mich. All five screws are driven into the stator simultaneously and with precision torque control. This automated equipment is mounted on a plate as a component part of the stator assembly conveyor line. It is completely automatic and is actuated by a limit switch when a stator is brought into the proper location by the conveyor. The machine handles 700 transmission stators an hour, driving clutch-head

Automatic storage feeder for heavy parts made by Campbell Machines Co.



Automated multiple screwdriver brought out by the D & L Tool & Machine Co.

screws at the rate of 3500 per hour.

An alternate manual switch facilitates the operation of either the hopper or the multiple screw-driving unit separately for setup or tryout purposes.

All electrical and pneumatic equipment and installations conform to JIC standards. The machine is self-contained and ready for operation when wired to a 440-volt, 60-cycle line and connected to a 1-inch air pipe line with line pressure.

Circle Item 123 on postcard, page 257

Spindles for Dearbornaire Air Gage Instruments

Stock delivery of air gage spindles for their Dearbornaire column type gage instruments and accessories, or similar standard air instruments of other makes or models, is announced by the Air Gage Division, Dearborn Gage Co., Dearborn, Mich. These air gage spindles are available in steel, chromium, and carbide in through-hole, counterbore, and blind types in sizes ranging from 0.275 inch to 3 inches in diameter.

Circle Item 124 on postcard, page 257

Dual Agitator Tank Attachment for Lapmaster

A dual agitator tank attachment that permits both coarse and fine lapping on the Model 24 Lapmaster is available from the Crane Packing Co., Morton Grove, Ill. With this equipment, coarse abrasive can be used in one tank and fine abrasive in the other. Where lapping tolerances are not critical, it is unnecessary to change laps and conditioning rings when switching from one tank to the other.

Where fine lapping is required, such as on surfaces of seats for the mechanical seal, a second lap and a set of conditioning rings are required. These are changed as the lapping operation is switched from coarse to fine, and vice versa.

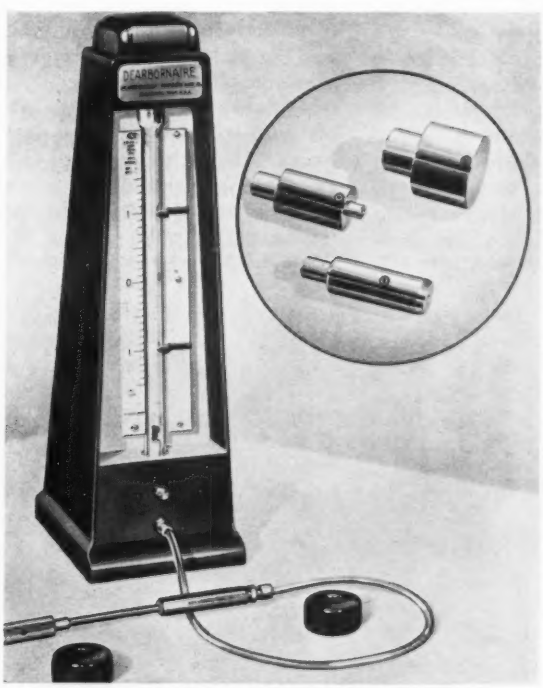
Lapmaster lapping machines will generate surface flatness to less than one light band and finishes to 2 micro-inches on parts varying from shaver blades to diesel-engine cylinder heads. Materials include cast iron, steel, magnesium, aluminum, brass, carbon, ceramics, and plastics.

Circle Item 125 on postcard, page 257

Niagara press equipped with air motor inclining device

Air Motor Inclining Device

A fast-acting air motor inclining device is available as optional equipment on open-back, inclinable presses, Series E, A, and AA (45 to 200-ton models), built by the Niagara Machine & Tool Works, Buffalo, N. Y. Easily operated with a hand valve, this labor-saving mechanism is especially

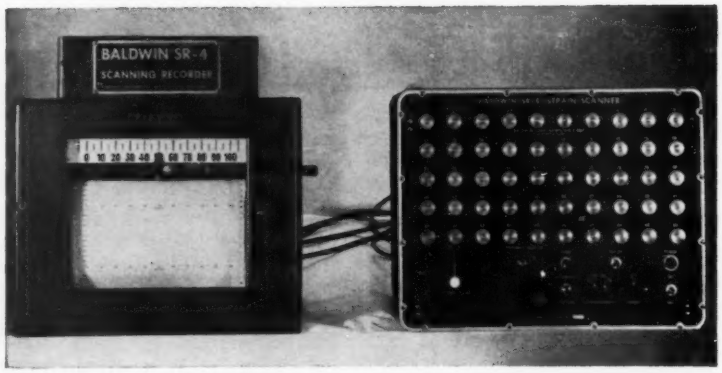


Dearbornaire column type gage and three air gage spindles of different sizes

Lapmaster equipped with dual agitator tank brought out by Crane Packing Co.

suitable for press work requiring frequent die changes. An air motor drives the inclining nut through a high-ratio worm-gear to move the press frame up or down. With a shop air pressure of 80 or 85 pounds per square inch, the press can be either inclined or brought upright over the full 30-degree range in approximately two minutes. The device has a self-locking feature designed to insure maximum safety and to keep the press from dropping through air failure.

Circle Item 126 on postcard, page 257



Scanning recorder built by Baldwin-Lima-Hamilton Corporation

Unicaster Die-Casting Machine

A Unicaster Model 120, 450-ton capacity die-casting machine, designed for safe, economical operation, has been brought out by the Unit Products Division of Uniloy Corporation, Saline, Mich. Outstanding advantages claimed for this machine include a simplified, compact, and self-contained hydraulic system mounted on a subbase; the elimination of all pilot lines; and the coupling of all hydraulic pipes with welded flange fittings to reduce the possibility of oil leaks or hydraulic shock.

Other important features are the simplified tank clean-out with easily accessible oil filters that eliminate the need for tank drainage; extra heavy toggle system; and extra large accumulator tank. All four tie-bars can be pulled without dismantling any part of the machine—a feature that facilitates maintenance.

Electrical controls permit operation of the equipment on an automatic cycle or manually.

Circle Item 127 on postcard, page 257

Pipe- and Flange-Facing Machine

A pipe- and flange-facing machine with a single head that accommodates pipe from 2 to 24 inches in diameter is announced by Forney's Inc., New Castle, Pa. This machine is made either for manual or electric-hydraulic automatic cycle operation. When equipped with various types of fixtures and rotary tables instead of the steadyrest, it can be used for facing flange type valves and fittings ranging from 2 to 36 inches in diameter.

The machine is designed for heavy production work, using carbide tools. Multiple heads can be provided so that several operations can be performed simultaneously.

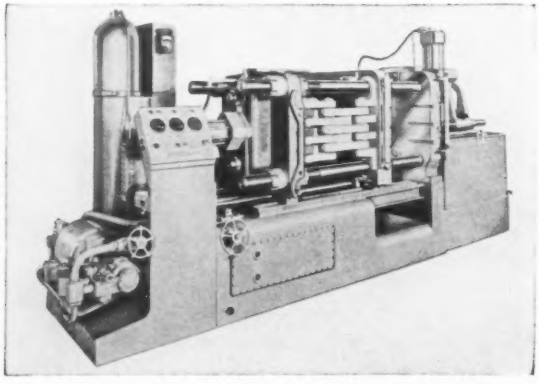
Circle Item 128 on postcard, page 257

Baldwin Automatic Scanning Recorder

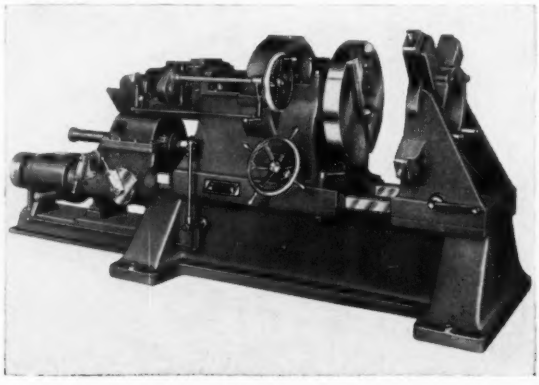
The Baldwin 50-point, automatic scanning recorders for SR-4 strain gages and SR-4 transducers have been improved and redesigned to accommodate both two- and four-arm strain gage bridges. These new recorders are said to provide greater flexibility of operation, present more useful data, and offer an additional lower strain range. They are now being built by the Electronics and Instrument Division of Baldwin-Lima-Hamilton Corporation, Waltham, Mass.

The accommodation of both two- and four-arm strain gage bridges permits automatic measurements either with such SR-4 transducers as standard load cells or with resistance wire strain gages. The equipment plots a complete sequence of 50 points in thirty to ninety seconds, depending on strain levels.

Circle Item 129 on postcard, page 257



Improved die-casting machine brought out by Unit Products Division of Uniloy Corporation

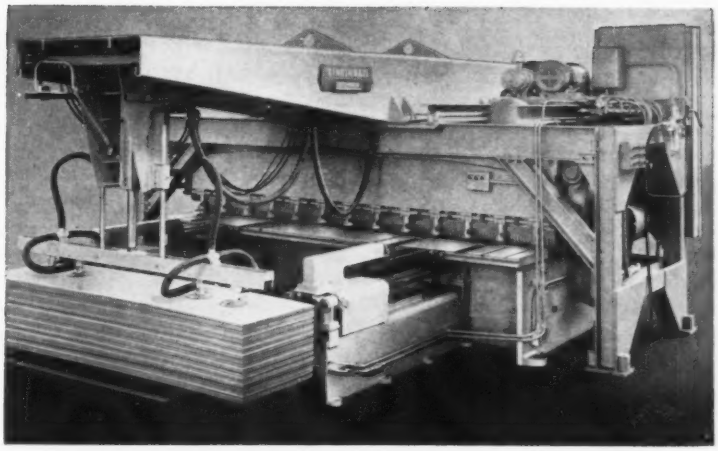


Pipe- and flange-facing machine made for manual or automatic cycle operation by Forney's Inc.

Cincinnati "Auto-Shear"

An "Auto-Shear," which is essentially a standard 1812 series Cincinnati shear employed in conjunction with automatic handling equipment to form an automated sheared-blank production unit, is being manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio. The "Auto-Shear" picks up the unsheared plate, deposits it on the table, feeds it into the shear against the back-gage, makes the cut, conveys the sheared blanks beyond the rear of the machine, picks them up and stacks them neatly—all automatically. Power sources for the various material-handling components can be varied to suit requirements.

Circle Item 130 on postcard, page 257



"Auto-Shear" using suction cup pick-up for handling plate material

"Koil Kradle" Straightener

The Benchmaster Mfg. Co., Gardena, Calif., has announced a "Koil Kradle" straightener combination, rated at 4000 pounds maximum capacity, which accommodates coils up to 60 inches in diameter and 18 inches wide. The maximum stock thickness handled by this straightener is 0.045 inch. The combination of cradle and straightener automatically supplies a controlled slack loop of straight, flat stock for withdrawal by any machine. With this arrangement, feeding devices are not required to pull against the weight of a heavy coil.

The unit is also equipped with the Benchmaster "Variloop" control—a feature which delays motor shut-off for any desired period up to ten seconds after the slack loop is fully formed. This prevents unnecessary motor starts and stops, smooths out material flow, and eliminates wear. All electrical controls are made to conform to JIC standards.

Circle Item 131 on postcard, page 257

Greenlee "Hydro-Borer"

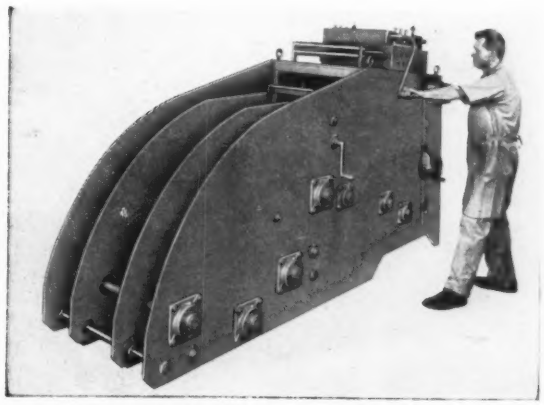
A low-cost, precision boring machine, called the Model C-4 "Hydro-Borer," has been announced by Greenlee Bros. & Co., Rockford, Ill. Tolerances of plus or minus 0.0003 inch and finishes to 30 micro-inches can be achieved with this machine.

This precision boring equipment can be built right into production setups as it can be mounted on any type of base. Fixtures can be mounted directly on the face at an angle of 90 degrees to the spindle. The machine can be furnished with an automatic trip and spindle return.

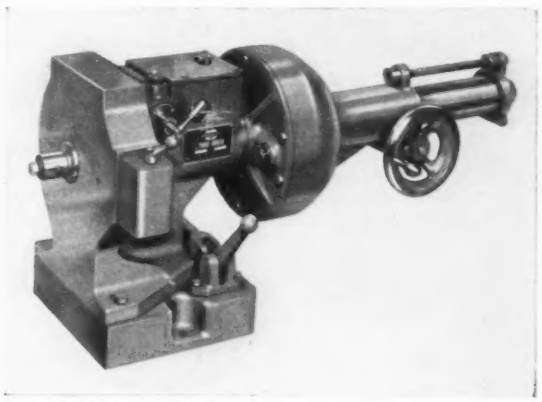
The spindle is 1 1/4 inches in diameter and has a No. 2 Morse taper. The taper can be supplied in either concentric or eccentric style. Eccentric taper permits increasing the bore diameter capacity by a total of 0.014 inch in increments of 0.001 inch without resetting the tool bit.

Through a patented principle of positive feed by oil displacement, feed is available in one of two ranges—either 0.002 to 0.004 inch or 0.0035 to 0.007 inch. The oil reservoir is cast integrally with the main housing. Feeds in either direction are obtained by reversing rotation. An adjustable stop is provided when using the feed in either direction.

Circle Item 132 on postcard, page 257



"Koil Kradle" straightener made by Benchmaster Mfg. Co.



"Hydro-Borer" announced by Greenlee Bros. & Co.

Automatic "Square-Axis" Microhoning Machine

A completely automated Model 738 Microhoner that generates the bore of a part square with its parallel end faces to provide accurate locating surfaces for subsequent operations is announced by the Micromatic Hone Corporation, Detroit, Mich. Automatic loading of parts is accomplished by means of a large-capacity loader and a gravity chute which carries the work-piece to the prefeed position. A plunger moves the part onto the fixture table. As the table rises, the part slips over the tool which expands, aligning the work with the spindle. The work is then clamped on its parallel end faces.

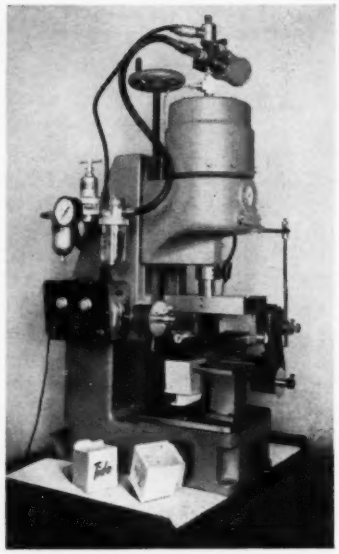
Automatic sizing (through Microsize control) ends the Microhoning cycle when the bore has reached the required diameter. The table is automatically lowered to move the finished part out of the Microhoning position. Automatic after-gaging of the finished part by an air gage occurs while the next part is being Microhoned. The Microhoned diameter size is indicated on a dial.

As the parts leave the machine they are segregated according to the bore diameters. An automatic stonewear indicator, electrically interlocked with the machine controls, visually indicates the amount of usable abrasive in the tool. The machine is automatically shut down when the abrasive is completely worn down or if a predetermined number of parts are not within tolerances.

A small gear blank whose bore must be generated square with the parallel end faces, within close tolerances, is processed at a high-production rate on this machine. This assures proper fit on the arbor for cutting the teeth so that the pitch circle is concentric with the axis of the bore. The pinion gear blank is of soft steel. Production is at the rate of 125 blanks per hour (gross). The bore size is held to a tolerance of 0.0003 inch; bore-to-face squareness to 0.0003 inch; and roundness and taper to 0.0001 inch.

Circle Item 133 on postcard, page 257

Two Model 738 Microhoners mounted side by side for high-volume production



Hot-stamping press brought out by the Acromark Co.

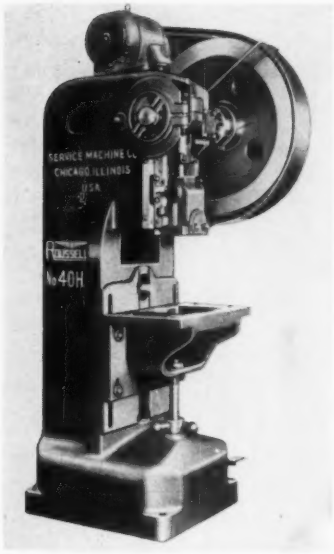
Acromark Hot-Stamping Press

A hot-stamping press that will stamp up to 1000 pieces per hour with manual feed, or possibly three times as many with an automatic feed, is announced by the Acromark Co., Elizabeth, N. J. This new press is designated the "Acroleaf" Model 250-H and has a die area 6 by 6 inches. It takes roll leaf up to 6 inches in width and has an adjustable die space 9 1/2 inches high, with a throat depth of 8 inches. Automatic controls regulate the temperature of the heated head, the marking pressure, the dwell, and the foil advance. Adjustments can be pre-set by the operator to meet the requirements of each individual job. Sufficient rigidity and power are provided to stamp most thermosetting materials, as well as plastics, fibre, wood, paper, and coated metals.

The illustration shows the press equipped with a special head used for simultaneously hot-stamping the outside and the inside of two box type products.

The press requires connection to a standard 75- to 150-pound-per-square-inch air line and to a 100- to 120-volt electric line. It weighs 370 pounds and is about 15 inches wide by 24 inches deep.

Circle Item 134 on postcard, page 257



Horn type press built by Service Machine Co.

Rousselle Horn Press

A 40-ton-capacity horn press designed for simplicity, flexibility, and accuracy has been brought out by the Service Machine Co., Chicago, Ill. Besides handling horning operations such as forming, punching, and riveting hollow, odd-shaped, or cylindrical work, this press has an adjustable bed table that accommodates dies and fixtures requiring a large die space between bed and slide.

Die space adjustment is made by merely turning a hand screw. Slugs and blanks can fall through the table opening without interference from the elevating screw. Special bed tables can be furnished for additional die space or for unusual applications. Standard equipment includes over-size, single-stroke clutch; roller bearing flywheel; and replaceable bearings.

Circle Item 135 on postcard, page 257

Precision Boring and Milling Machine

The W. B. Knight Machinery Co., St. Louis, Mo., has announced a No. 60 vertical boring and milling machine designed to handle a wide range of precision work. This machine is built in two sizes. The smaller machine, with a heavy 18- by 52-inch bed type table, has a cross-travel of 18 inches and a longitudinal travel of 28 inches. The larger machine, with an 18- by 60-inch table, has a cross-travel of 18 inches and a longitudinal travel of 36 inches. Both machines have a vertical capacity of 30 inches.

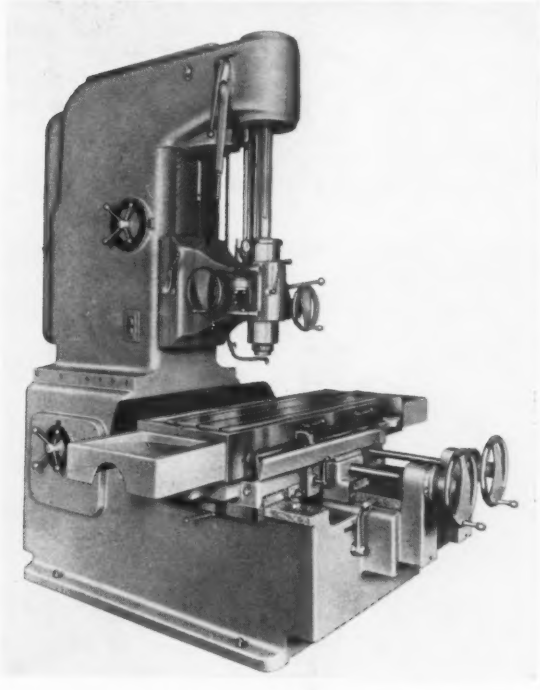
Circle Item 136 on postcard, page 257

Circular Hole-Pattern Drilling Machine

Sixty-eight holes are drilled to conform with a circular hole-pattern layout in a cast-iron gas burner with a radial drilling machine brought out by Zagar, Inc., Cleveland, Ohio. The 1/8-inch holes are drilled in two passes—thirty-four holes being drilled simultaneously—at an angle of 45 degrees.

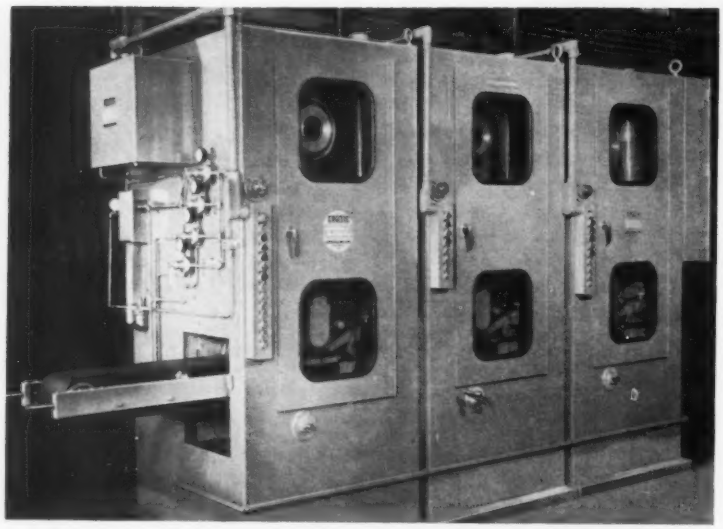
The operator loads the work into an air-actuated clamping fixture located on an index-table. The drill head, equipped with thirty-four drills, is fed automatically, the drills being gear-driven into and out of the burner by cam feed electrical control. When the drills retract, the operator indexes the part to the correct position for drilling the holes in the other half of the circular layout. The drilling cycle is repeated, and the operator unloads the fixture after the second pass. Up to 135 burners are drilled per hour.

Circle Item 137 on postcard, page 257



Knight boring and milling machine

Zagar multiple-spindle drilling machine



Curtis "Straight-O-Matic" grinding, polishing, and deburring machine

"Straight-O-Matic" Grinding, Polishing and Deburring Machine

Coated abrasive belts are being used as efficient cutting tools in the "Straight-O-Matic" line of grinding, polishing, and deburring machines manufactured by the Curtis Machine Division of the Carborundum Company, Jamestown, N. Y.

The machine illustrated is the Model R600C-3, a unit that employs three abrasive belts over one conveyor belt. It is equipped for wet grinding, has an oil mist applicator, and automatic tracking and pneumatic tensioning control of the 10-inch wide abrasive belts. This unit makes possible a three-grit polishing sequence, three-step stock removal for sizing, or combinations of polishing and grinding.

Circle Item 138 on postcard, page 257

Utility Tray for Drill Press

The Patton Mfg. Co., Springfield, Ohio, has added a T-10 utility tray for drill presses to its line of "Champion" products. The utility tray is designed to aid drill press operators in regular job shop work and to reduce needless motion in production line operation.

These handy trays can be employed to hold drills, wrenches, and other items that are frequently used with the drill press. For production drill press work, the utility tray provides a convenient location for component parts. Trays are available in pairs or in right- or left-hand single units and to fit all standard 2-, 2 3/4-, and 3 1/2-inch drill press columns. Special trays can be supplied for drill press columns other than standard.

Circle Item 139 on postcard, page 257

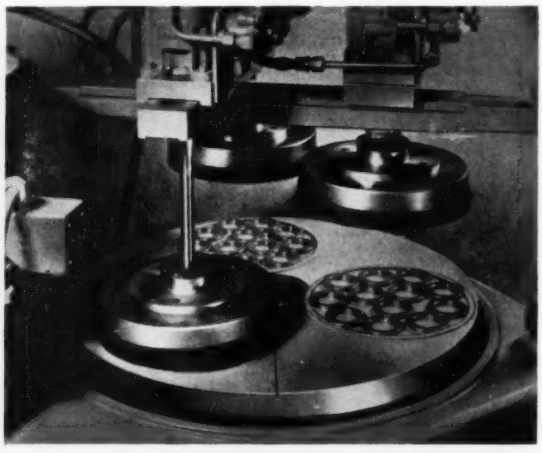
Polishing Equipment for Lapmaster Lapping Machine

The Crane Packing Co., Morton Grove, Ill., has announced that production polishing accessories and equipment are now available for conversion of the Model 24 Lapmaster lapping machine into a high-speed polishing unit. Thus equipped, this machine will handle a wide range of polishing work on different materials at a high production rate. For example, forty-five brass parts (2 inches in diameter) can be polished to a highly reflective surface within three minutes.

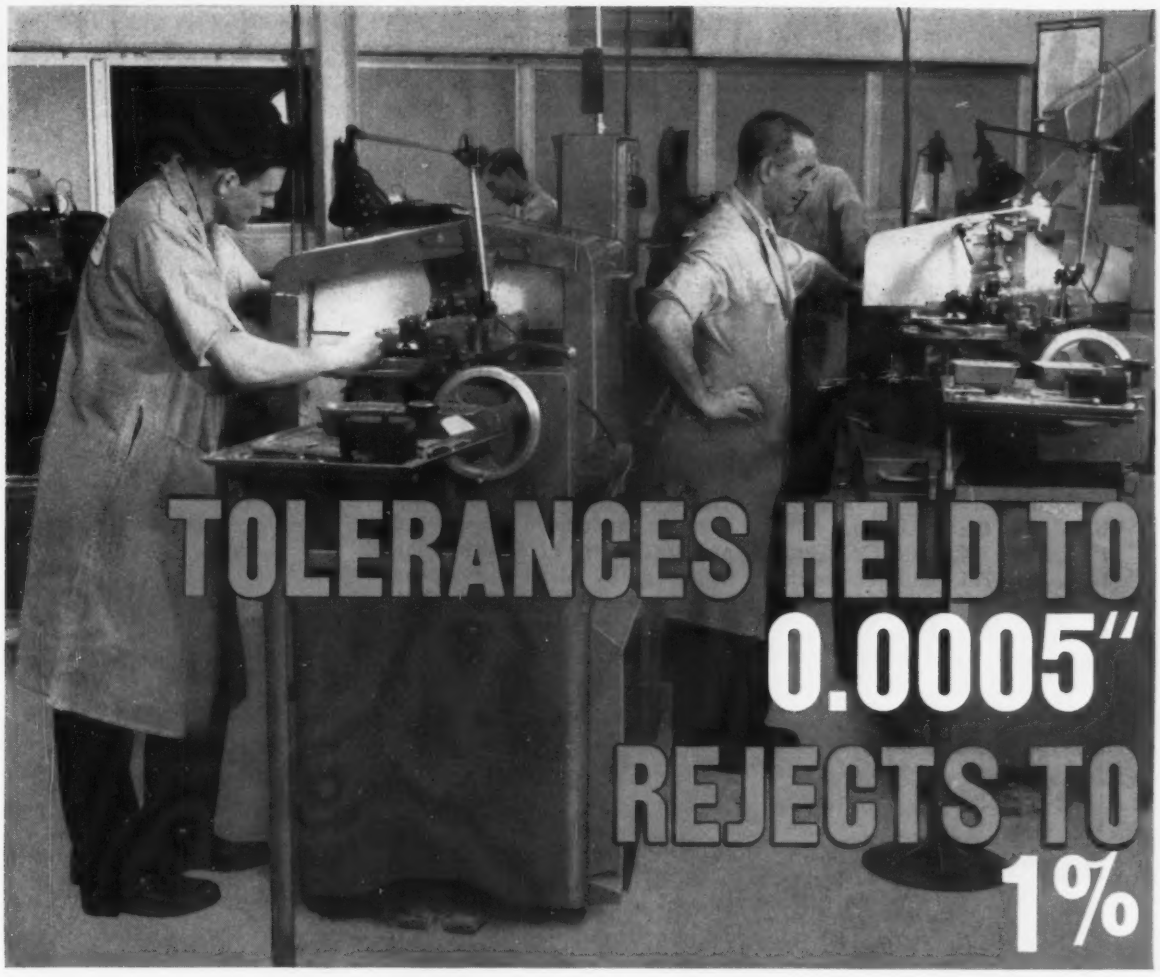
Tooling consists of a special lap-plate and pneumatic lifts; sponge neoprene pads for the pressure plates; 4/0 polishing paper discs; and double-sided sensitive tape for mounting the polishing paper on the lap-plate. Conversion for production polishing is readily accomplished.

Using the 4/0 polish paper, the

Drill press equipped with utility tray



Lapmaster equipped for production polishing



by Brown & Sharpe Automatic Screw Machines at Miniature Precision Bearings, Inc.

Ball bearings as small as .1000" O.D. meet critical specifications at Miniature Precision Bearings, Inc., Keene, N.H. Each tiny bearing component is held to severe tolerances. For example, the battery of B&S Automatics which produces the inner and outer race blanks and turns the races, maintains runout tolerances as close as 0.0005" Total Indicator Reading on diameters less than .0300". And rejects average only 1%!

The B&S Automatics save additional time too. On tough 52100 chrome steel bearing components, their super-accuracy lengthens carbide-tool life between sharpenings by as much as 4 hours! What's more, operators can work to closer dimensional limits with minimum set-up time. And secondary operations are minimized.

This is just one example of the increased accuracy, efficiency, and economy that Brown & Sharpe Machine Tools are making possible in every phase of metalworking. For *best* results in your milling, grinding, or screw machine operations, get complete information from Brown & Sharpe Mfg. Co., Providence, R. I.

These are typical products of Miniature Precision Bearings, Inc., Keene, N.H., the first U.S. plant specifically built for production of miniature ball bearings from .1000" to .3750" O.D. MPB bearings are used in products as widely different as clarinet keys and radar equipment—all must pass rigid tests for both accuracy and stamina.

SPECIFICATIONS: New High-Production B&S No. 00 Automatic

Takes stock diameter to	½"
Turns any length to	1"
Spindle speed range	7200 to 34 R.P.M.
Number of 2 speed combinations	208
Ratios of high to low speeds	2.3:1 to 16:1

Brown & Sharpe B·S

For more information fill in page number on Inquiry Card, on page 237

machine is especially recommended for polishing parts requiring low micro-inch finishes. It is said to assure a high-production rate without generating heat to distort parts. Flatness can generally be held under three light bands. Typical materials, together with finished polish readings, are: soft steel (3 to 4 micro-inches); hard steel, stainless steel, and brass (2 micro-inches). To obtain a closer or finer finish, and when polishing parts such as carbon, glass-filled Teflon, Bakelite, and similar materials, an alloy polishing plate is recommended.

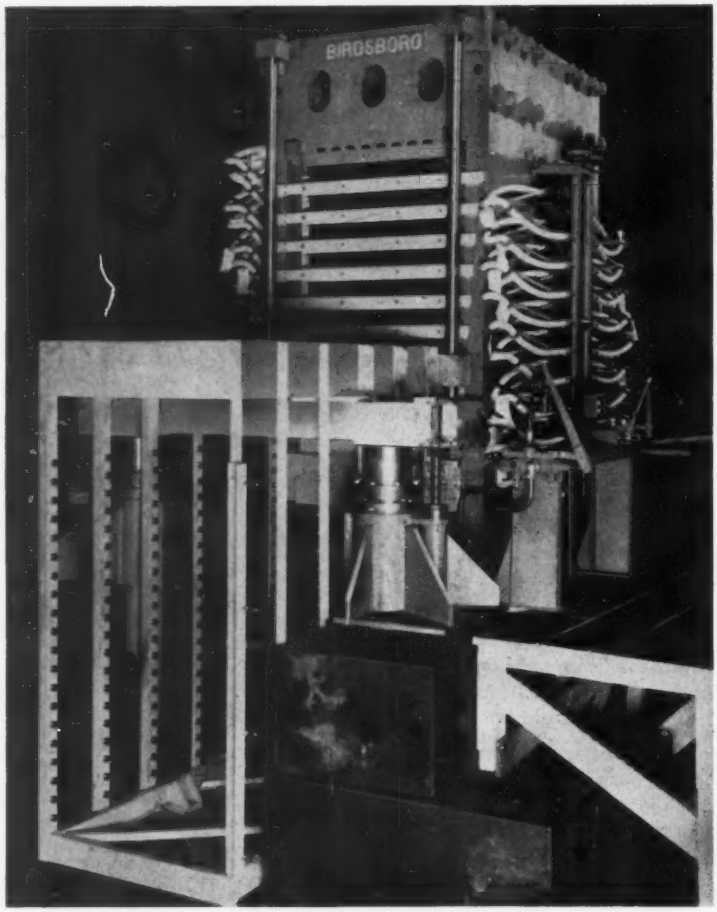
Circle Item 140 on postcard, page 257

Multiple-Opening Steam Platen Press

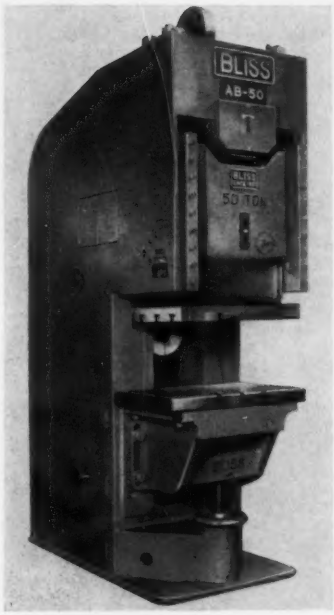
A 2200-ton, water-hydraulic press designed for the production of all types of laminated products—which has provisions for expediting loading, unloading, and preventing damage to the loading plates and steam plates—has been built by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. This multiple-opening steam platen press is of side-plate construction and has the side-plates keyed and bolted to the main cylinder as well as to the top platen.

A multiple-opening elevator attached to the front of the press permits loading every other opening during the pressing cycle. When the press is opened, the operator can unload the pressed product into the elevator and immediately, by advancing the elevator one position, reload the press from the elevator.

Circle Item 141 on postcard, page 257



Birdsboro 2200-ton, water-hydraulic multiple-opening platen press



Bliss 50-ton adjustable bed press

Bliss Adjustable Bed Press

A line of adjustable bed presses featuring a fully enclosed box type frame has been introduced by the E. W. Bliss Co., Canton, Ohio. The 50-ton press illustrated is the first size in the new line to have been manufactured. The complete line includes presses with capacities ranging from 50 to 150 tons. These fully enclosed presses have a box crown and box slide. All controls are completely built-in. Air controls and the recirculating oil unit are enclosed on the left-hand side of the press, while the press and motor controls are similarly flush-mounted on the right-hand side. Other features include a fast-acting air-friction clutch and brake and an adjustable rotary limit switch.

The 18- by 24-inch bed of the 50-ton model can be raised or lowered a distance of 9 inches, making possible a shut height adjustment of from 11 to 20 inches. This makes the press suitable for a variety of unwieldy stamping and forming jobs. The design of the welded steel frame, while exceptionally strong and rigid, requires little floor space. The 50-ton model is only 37 inches wide and 74 inches deep front to back.

Circle Item 142 on postcard, page 257
(This section continued on page 234)

Mighty productive this

Cincinnati FLAME-HARDENED HARD CLAD® COLUMN Radial

With its 3′ arm and 7½″ column . . . its 1¼″ capacity in cast iron . . . its 9 "right" spindle speeds and 6 power feeds . . . this new Cincinnati Radial will take on a multitude of drilling and allied jobs in your shop.

And it's *Cincinnati* engineered to give you extra years of high-productive service. The "Hard Clad" column is flame hardened to retain its built-in accuracies without scoring or pitting. Steel gears in speed and feed transmissions are hardened to provide maximum wearing qualities. All shafts are mounted on anti-friction bearings.

Cincinnati research, Cincinnati engineering are fully reflected in this advanced-design radial which combines high performance with low first cost and even lower maintenance cost. For the complete Cincinnati Radial story, see your local CL&T dealer or write direct for catalog data. Cincinnati Lathe and Tool Co., 3207 Disney St., Cincinnati 9, Ohio.

center on

cincinnati lathes and drills

Builders of Engine, Toolroom and Fixed Gap Bed Lathes and a Complete Line of Drilling Machines

Fig. 1. DoAll Model 5 contour machine set up for sawing a large die-block

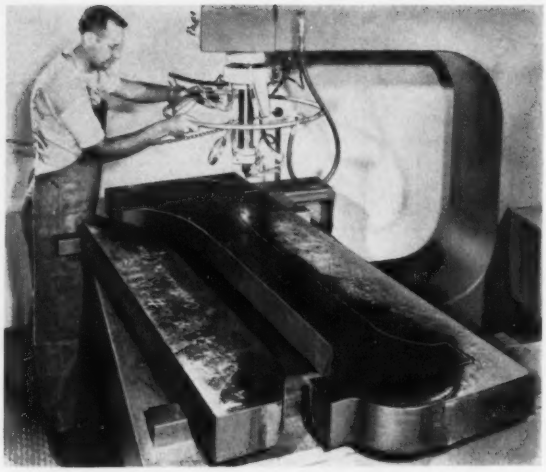


Fig. 2. Contour-sawing diesel engine connecting-rod with machine shown in Fig. 1

DoAll Contour Band-Sawing Machine

The DoAll Co., Des Plaines, Ill., has brought out a Model 5 contour band-sawing machine designed to handle heavy work. This machine is especially adapted for contour-sawing of large die-blocks as shown in Fig. 1 and for cutting out parts such as the diesel engine connecting-rod shown in Fig. 2. Other heavy, ungainly, or unbalanced parts can be easily produced because the heavy mass of metal from which the work-piece is cut remains stationary while the saw blade is fed along the layout guide lines.

The machine will take a straight cut 14 1/2 feet long and can cut contours of any design within a 70-square-foot area, as indicated in the diagram Fig. 3, without changing the position of its pedestal. This wide range of action makes the contour-sawing machine especially useful in the aircraft-frame and shipbuilding industries, where the cutting of large intricate contours is regularly required. The production of large, odd-shaped parts by the stack method can also be used.

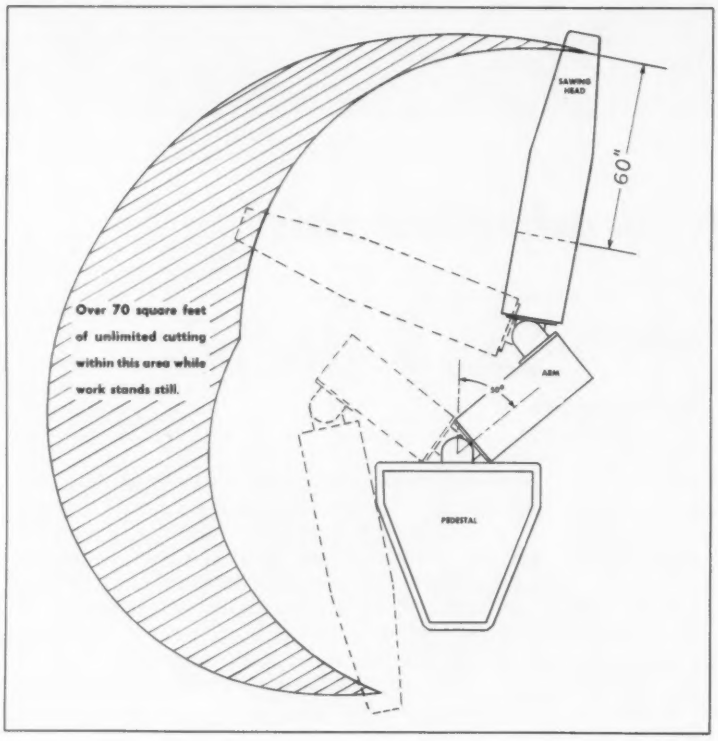


Fig. 3. Diagram indicating working range of DoAll contour-sawing machine

The machine achieves its wide range and ease of handling by means of an articulated construction which permits the sawing head to be moved over the work area as indicated in Fig. 3. The sawing head is shown in two of its extreme positions by dotted lines in the diagram. The cutting and guiding mechanisms with all the necessary parts for cutting and power feeding are carried by the sawing head or yoke which is fabricated of aluminum to reduce its inertia. Between the sawing head, or yoke, and the stationary member which is fastened to the floor is an intermediate member. These three members are connected by hinges using anti-friction bearings which permit the saw blade to move within the 70-square-foot area.

The yoke houses a complete four-wheel, variable-speed band-sawing machine. The upper and lower saw-blade guides are mounted on tubular posts through which the saw blade travels. Both

FOUND WHERE AIRCRAFT POWER AND CONTROLS TAKE SHAPE

GRAND RAPIDS GRINDERS

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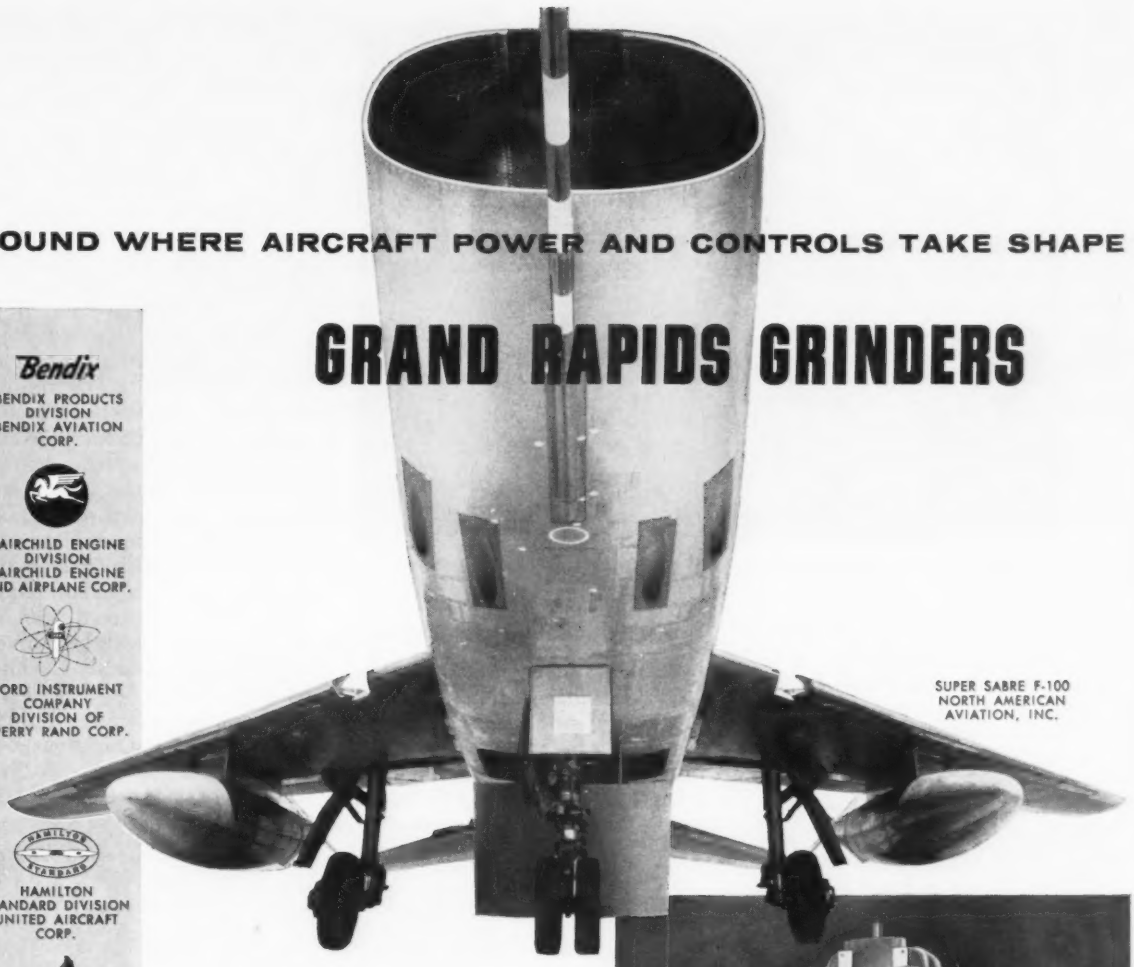
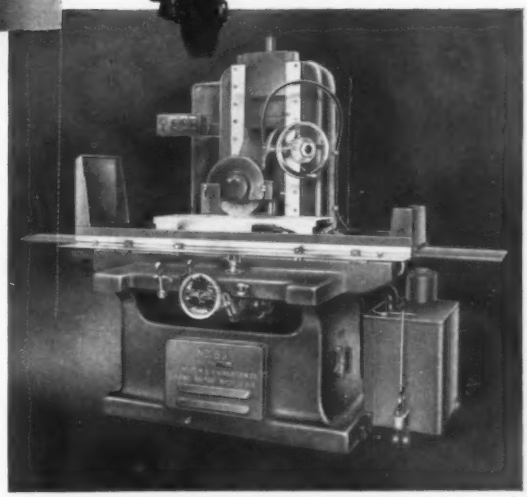


SUPER SABRE F-100
NORTH AMERICAN AVIATION, INC.

Precision is paramount in the manufacture of components for aircraft power and control. That's why these makers of precision parts have Grand Rapids Grinders in their toolrooms — for the utmost in precision grinding.

Model No. 55, for example, features one-piece column and base for permanent vibrationless rigidity. Longitudinal travel table and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. And it's faster than any other grinder of this type and size . . . with variable table speed up to 125 fpm.

With these built-in precision features typical of all Grand Rapids Grinders, it's no wonder they're found in leading toolrooms.



GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

A note on your letterhead will bring full details.

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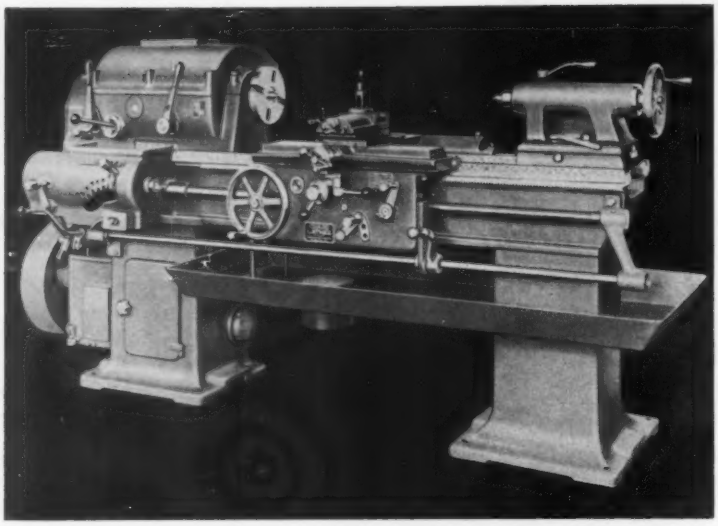


Chard multi-speed lathe made by the Western Machine Tool Works

posts telescope to permit adjustment for work thickness. The posts carrying the saw-blade guides and the power feed wheel, located directly below the saw blade guides and in contact with the floor, are connected to a countershaft by means of sprockets and chains. Any movement of the top post is thereby transmitted to the bottom post and to the feed wheel which serves to traverse the sawing head over the working area. The handwheel connected to the top post permits the operator to twist the saw blade in either direction. The maximum twist in either direction—up to 180 degrees—is determined by the maximum twisting stress, which varies with the size of the saw band. Turning the handwheel turns the lower feed wheel at the same time the blade is turned and thus permits the operator to steer or guide the saw band along the layout lines.

The power feed wheel is rubber-tired and rests on the floor. It is driven by a torque motor and causes the entire yoke to move in the direction in which the saw blade is pointed. The force of the feed is controlled by a rheostat; and the feed wheel can be raised by means of an air cylinder so that the cutting head may be swung freely when desired. Also included in the yoke are the hydraulic motors which drive the two bottom band wheels.

Circle Item 143 on postcard, page 257

Chard Heavy-Duty Lathes

The Western Machine Tool Works, Holland, Mich., are manufacturing a Chard heavy-duty, geared-head lathe in 16-, 18-, and 20-inch sizes with bed lengths of 7 feet. An outstanding feature of these machines is the gear-box located at the head end cabinet leg and containing four changes of speed, the start-stop clutch mechanism, spindle brake, and chain sprocket, for driving direct to the spindle in the headstock above. This arrangement of segregating the majority of the high-speed gearing relatively close to the floor line and away from the main spindle serves to isolate vibration, reduce stresses in the headstock casting, and add to the general stability of the machine.

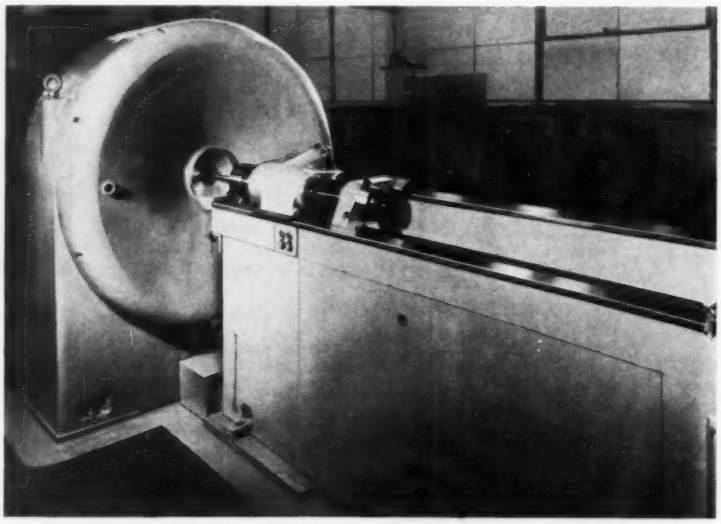
Eight back-geared speed changes are obtained by means of hardened alloy steel toothed clutches, sliding on multiple keys. The four highest speeds are transmitted direct to the spindle from the gear-box through a Twin Disc clutch running in a filtered oil spray. The heavy-duty screw type spindle nose is standard equipment, but a National Standard long taper nose with key drive is supplied on demand. A direct-reading index-plate is applied to the headstock, listing all thread lead and feed combinations available, including thirty-two horizontal feeds from 0.004 to 0.100 inch per revolution.

Circle Item 144 on postcard, page 257

Fellows-Appel Cold-Forming Machine

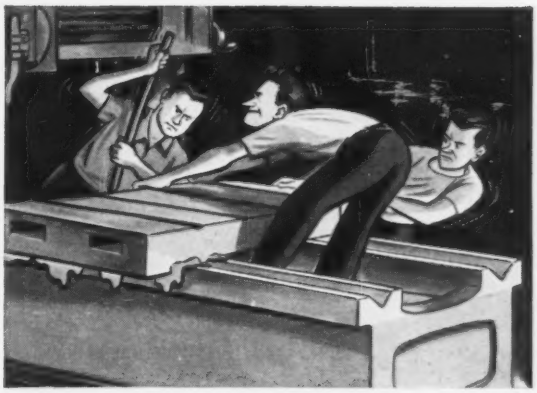
The Fellows Gear Shaper Co., Springfield, Vt., has announced a machine for cold-forming metals by the Appel process for which it has acquired the exclusive manufacturing license in the United States and Canada. The Appel process comprises cold-forming through kneading or plasticizing

(*Continued on page 243*)



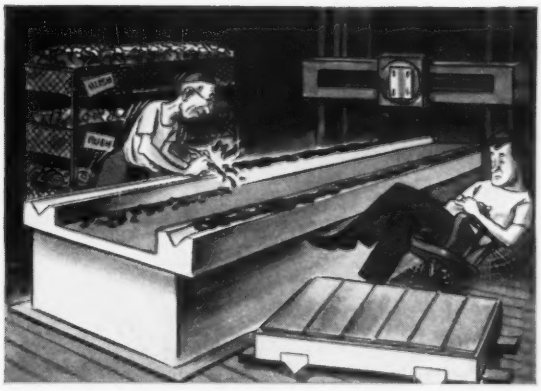
Cold-forming machine introduced by the Fellows Gear Shaper Co.

1. Cures "stick-slip" or "jumpy table". When a table gets the "shakes", especially after it has just reversed or when the load is heavy and the speed slow, it's probably suffering from "stick-slip". Remedy—Sunoco Way Lubricant®. Special polar compounds in Sunoco Way Lubricant form a friction-reducing film that keeps a table sliding smoothly under all operating conditions.



2. Doesn't squeeze out. When you use a heavy oil as a way lubricant, you must use a lot of oil to maintain a thick enough film. But, heavy oil squeezes out if the table sits in one position very long. You have a tough time getting the table moving again. Protected by the tenacious thin film formed by Sunoco Way Lubricant, the machine can be idle for a week and it will start easily.

WHY SUNOCO WAY LUBRICANT CAN HELP CURE YOUR MACHINING PROBLEMS



3. Protects expensive ways. Badly scored or pitted ways, caused by inadequate way lubrication, result in lost production and expensive repairs. The high film strength of Sunoco Way Lubricant eliminates the danger of metal-to-metal contact, the chief cause of scoring and way wear. Excellent metal-wetting and non-corrosive properties eliminate rusting and pitting.

For the lubrication of slides and ways on this machine, we recommend the use of
SUNOCO WAY LUBRICANT
a product of
SUN OIL COMPANY

4. Approved by more than 55 machine-tool builders. Every major machine-tool builder has tested Sunoco Way Lubricant. It is always approved. In fact, to assure maximum efficiency of their product, many manufacturers ship a supply of Sunoco Way Lubricant with each machine. We'll be glad to send you the list of manufacturers who have approved Sunoco Way Lubricant.

For more information, see your Sun Representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-3.

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FOUR WAYS TO IMPROVE YOUR GAGING PROGRAM

Starrett® HIGH PRECISION LOW FRICTION **Dial Indicators**

1 CUT MAINTENANCE

With fewer parts and interchangeable gear assemblies in No. 25, No. 655 and No. 656 sizes, Starrett Dial Indicators cut maintenance costs. You keep more indicators in service longer with fewer spare parts to stock. The entire gear assembly can be removed as a unit for convenience in servicing.

2 IMPROVE ACCURACY

Simplified design with rugged, rigid construction means Starrett Dial Indicators are less subject to friction and wear. Replaceable low friction jeweled or inserted bronze bearings align accurately to eliminate end play. Rustproof stainless steel gears and tempered pinions, stainless and tempered racks and spindles and heavier bridge and case, all make for lasting accuracy.

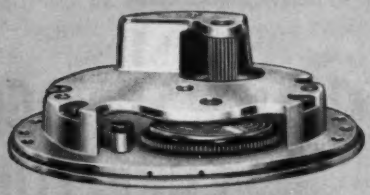
3 INCREASE EFFICIENCY

New easy-reading dials, satin chrome exterior finish and contrasting black bezels help operators read faster and more accurately with less eye fatigue. Count hands on long range models read directly in decimals . . . no calculations.

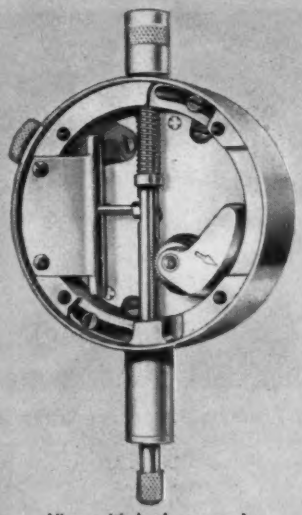
4 IMPROVE PERFORMANCE

Direct acting springs completely around the spindle or rack eliminate cocking and side friction. Action is smoother, more accurate, with less contact pressure. And with the new Nonshock mechanism to stop shock *before* it reaches the gear train, Starrett indicators stand up longer even on brutal gaging applications.

Front view showing easy-reading dial with contrasting black bezel



Interchangeable gear mechanism features simplified unit construction



View with back removed showing inside mechanism

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Buy through your INDUSTRIAL DISTRIBUTOR — Prompt delivery · Dependable service · Quality products

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WORLD'S GREATEST TOOLMAKERS

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Athol, Massachusetts

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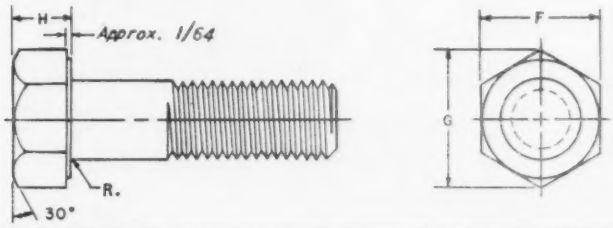
AMERICAN STANDARD REGULAR SEMIFINISHED HEXAGON BOLTS



Nominal Size or Basic Major Diameter of Thread		Body Diam.	Width Across Flats F			Width Across Corners G		Height H			Radius of Fillet R	
		Max.	Max. (Basic)		Min.	Max.	Min.	Nom.	Max.	Min.	Min.	Max.
1/4	0.2500	0.260	7/16	0.4375	0.425	0.505	0.484	5/32	0.163	0.150	0.009	0.031
5/16	0.3125	0.324	1/2	0.5000	0.484	0.577	0.552	13/64	0.211	0.195	0.009	0.031
3/8	0.3750	0.388	9/16	0.5625	0.544	0.650	0.620	15/64	0.243	0.226	0.009	0.031
7/16	0.4375	0.452	5/8	0.6250	0.603	0.722	0.687	9/32	0.291	0.272	0.009	0.031
1/2	0.5000	0.515	3/4	0.7500	0.725	0.866	0.826	5/16	0.323	0.302	0.009	0.031
5/8	0.6250	0.642	15/16	0.9375	0.906	1.083	1.033	25/64	0.403	0.378	0.021	0.062
3/4	0.7500	0.768	1 1/8	1.1250	1.088	1.299	1.240	15/32	0.483	0.455	0.021	0.062
7/8	0.8750	0.895	1 5/16	1.3125	1.269	1.516	1.447	35/64	0.563	0.531	0.031	0.062
1	1.0000	1.022	1 1/2	1.5000	1.450	1.732	1.653	39/64	0.627	0.591	0.062	0.093
1 1/8	1.1250	1.149	1 11/16	1.6875	1.631	1.949	1.859	11/16	0.718	0.658	0.062	0.093
1 1/4	1.2500	1.277	1 7/8	1.8750	1.812	2.165	2.066	25/32	0.813	0.749	0.062	0.093
1 3/8	1.3750	1.404	2 1/16	2.0625	1.994	2.382	2.273	27/32	0.878	0.810	0.062	0.093
1 1/2	1.5000	1.531	2 1/4	2.2500	2.175	2.598	2.480	15/16	0.974	0.902	0.062	0.093
1 3/4	1.7500	1.785	2 5/8	2.6250	2.538	3.031	2.893	1 3/32	1.134	1.054	0.078	0.125
2	2.0000	2.039	3	3.0000	2.900	3.464	3.306	1 7/32	1.263	1.175	0.078	0.125
2 1/4	2.2500	2.305	3 3/8	3.3750	3.262	3.897	3.719	1 3/8	1.423	1.327	0.125	0.188
2 1/2	2.5000	2.559	3 3/4	3.7500	3.625	4.330	4.133	1 17/32	1.583	1.479	0.125	0.188
2 3/4	2.7500	2.827	4 1/8	4.1250	3.988	4.763	4.546	1 11/16	1.744	1.632	0.125	0.188
3	3.0000	3.081	4 1/2	4.5000	4.350	5.196	4.959	1 7/8	1.935	1.815	0.125	0.188
3 1/4	3.2500	3.335	4 7/8	4.8750	4.712	5.629	5.372	2	2.064	1.936	0.125	0.188
3 1/2	3.5000	3.589	5 1/4	5.2500	5.075	6.062	5.786	2 1/8	2.193	2.057	0.125	0.188
3 3/4	3.7500	3.858	5 5/8	5.6250	5.437	6.495	6.198	2 5/16	2.385	2.241	0.125	0.188
4	4.0000	4.111	6	6.0000	5.800	6.928	6.612	2 1/2	2.576	2.424	0.125	0.188

All dimensions given in inches.

Semifinished bolt is processed to produce a flat bearing surface under head only.

Taper of head (angle between one side and axis) shall not exceed 2 degrees, specified width across flats being the largest dimension.

Top of head shall be flat and chamfered. Diameter of top circle shall be maximum width across flats within a tolerance of minus 15 per cent.

Bearing surface shall be flat and washer-faced. Diameter of washer face shall be 95 per cent of maximum width across flats within a tolerance of plus or minus 5 per cent.

Bearing surface shall be at right angles to axis of body within a tolerance of 2 degrees for sizes up to and including 1 inch and within a tolerance of 1 degree for sizes larger than 1 inch. The bearing surface shall be concentric with axis of body within a tolerance of 3 per cent of the maximum width across flats.

Minimum thread length shall be twice the diameter plus 1/4 inch for lengths up to and including 6 inches; twice the diameter plus 1/2 inch for lengths over 6 inches. The tolerance shall be plus 3/16 inch or 2 1/2 threads, whichever is greater. On products that are too short for minimum thread lengths, the distance from the bearing surface of the head to the first complete thread shall not exceed the length of 2 1/2 threads, as measured with a ring thread gage, for sizes up to and including 1 inch, and 3 1/2 threads for sizes larger than 1 inch.

Thread shall be coarse-thread series, Class 2A.

Point shall be flat and chamfered or rounded at manufacturer's option, length of point not to exceed length of 1 1/2 threads from extreme point to first full thread.

Tolerance on bolt length for bolts 6 inches and under in length shall be plus or minus 1/32 inch for sizes 1/4 to 3/8 inch; plus or minus 1/16 inch for sizes 7/16 and 1/2 inch; plus or minus 1/8 inch for sizes 5/8 to 1 1/4 inches; and plus or minus 1/4 inch for sizes 1 3/8 to 4 inches. Length tolerance for bolts over 6 inches in length shall be plus or minus 1/16 inch for sizes 1/4 to 3/8 inch; plus or minus 3/32 inch for sizes 7/16 and 1/2 inch; plus or minus 3/16 inch for sizes 5/8 to 1 1/4 inches; and plus or minus 1/4 inch for sizes 1 3/8 to 4 inches.

Bolts shall enter ring gage to head; ring gage shall have a maximum thickness of one diameter, a minimum fillet equal to the maximum fillet of the bolt, and an internal diameter equal to specified maximum body diameter.

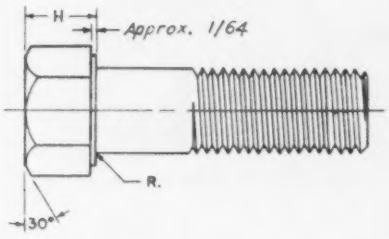
Suitable material for steel bolt is covered in Tentative Specification for Steel Machine Bolts and Nuts and Tap Bolts of the American Society for Testing Materials (ASTM A-307); suitable material for high-strength steel bolt is covered by ASTM Tentative Specification for Quenched and Tempered Steel Bolts and Studs with Suitable Nuts and Plain Washers (ASTM A-325).

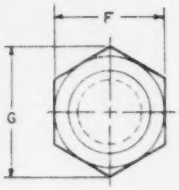
* There may be a reasonable swell or fin under the head or die seam on the body not to exceed the nominal body diameter by the following: 0.030 inch for sizes up to 1/2 inch; 0.050 for sizes 5/8 and 3/4 inch; 0.063 for sizes over 3/4 inch up to 1 1/4 inches; 0.093 for sizes over 1 1/4 inches up to 2 inches; 0.125 for sizes over 2 inches up to 3 inches; and 0.188 inch for sizes over 3 inches.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

MACHINERY'S DATA SHEET

AMERICAN STANDARD HEAVY SEMIFINISHED HEXAGON BOLTS





Nominal Size or Basic Major Diameter of Thread		Body Diam.	Width Across Flats F			Width Across Corners G		Height H			Radius of Fillet R	
		Max.	Max. (Basic)		Min.	Max.	Min.	Nom.	Max.	Min.	Min.	Max.
1/2	0.5000	0.515	7/8	0.8750	0.850	1.010	0.969	13/32	0.426	0.386	0.009	0.031
5/8	0.6250	0.642	1 1/16	1.0625	1.031	1.227	1.175	1/2	0.522	0.478	0.021	0.062
3/4	0.7500	0.768	1 1/4	1.2500	1.212	1.443	1.383	19/32	0.618	0.570	0.021	0.062
7/8	0.8750	0.895	1 7/16	1.4375	1.394	1.660	1.589	11/16	0.714	0.662	0.031	0.062
1	1.0000	1.022	1 5/8	1.6250	1.575	1.876	1.796	3/4	0.778	0.722	0.062	0.093
1 1/8	1.1250	1.149	1 13/16	1.8125	1.756	2.093	2.002	27/32	0.874	0.814	0.062	0.093
1 1/4	1.2500	1.277	2	2.0000	1.938	2.309	2.209	15/16	0.970	0.906	0.062	0.093
1 3/8	1.3750	1.404	2 3/16	2.1875	2.119	2.526	2.416	1 1/32	1.065	0.997	0.062	0.093
1 1/2	1.5000	1.531	2 3/8	2.3750	2.300	2.742	2.622	1 1/8	1.161	1.089	0.062	0.093
1 3/4	1.7500	1.785	2 3/4	2.7500	2.662	3.175	3.035	1 5/16	1.352	1.272	0.078	0.125
2	2.0000	2.039	3 1/8	3.1250	3.025	3.608	3.449	1 7/16	1.482	1.394	0.078	0.125
2 1/4	2.2500	2.305	3 1/2	3.5000	3.388	4.041	3.862	1 5/8	1.673	1.577	0.125	0.188
2 1/2	2.5000	2.559	3 7/8	3.8750	3.750	4.474	4.275	1 13/16	1.864	1.760	0.125	0.188
2 3/4	2.7500	2.827	4 1/4	4.2500	4.112	4.907	4.688	2	2.056	1.944	0.125	0.188
3	3.0000	3.081	4 5/8	4.6250	4.475	5.340	5.102	2 3/16	2.248	2.128	0.125	0.188

All dimensions given in inches.

BOLD TYPE indicates products unified dimensionally with British and Canadian standards.

Semifinished bolt is processed to produce a flat bearing surface under head only.

Taper of head (angle between one side and axis) shall not exceed 2 degrees, specified width across flats being the largest dimension.

Top of head shall be flat and chamfered. Diameter of top circle shall be maximum width across flats within a tolerance of minus 15 per cent.

Bearing surface shall be flat and washer-faced. Diameter of washer face shall be 95 per cent of maximum width across flats within a tolerance of plus or minus 5 per cent.

Bearing surface shall be at right angles to axis of body within a tolerance of 2 degrees for sizes up to and including 1 inch and within a tolerance of 1 degree for sizes larger than 1 inch. The bearing surface shall be concentric with axis of body within a tolerance of 3 per cent of the maximum width across flats.

Minimum thread length shall be twice the diameter plus 1/4 inch for lengths up to and including 6 inches; twice the diameter plus 1/2 inch for lengths over 6 inches. The tolerance shall be plus 3/16 inch or 2 1/2 threads, whichever is greater. On products that are too short for minimum thread lengths, the distance from the bearing surface of the head to the first complete thread shall not exceed the length of 2 1/2 threads, as measured with a ring thread gage, for sizes up to and including 1 inch, and 3 1/2 threads for sizes larger than 1 inch.

Thread shall be coarse-thread series, Class 2A.

Point shall be flat and chamfered or rounded at manufacturer's option, length of point not to exceed length of 1 1/2 threads from extreme point to first full thread.

Tolerance on bolt length for bolts 6 inches and under in length shall be plus or minus 1/16 inch for 1/2-inch size; plus or minus 1/8 inch for sizes 5/8 to 1 1/4 inches; and plus or minus 1/4 inch for sizes 1 3/8 to 3 inches. Length tolerance for bolts over 6 inches in length shall be plus or minus 3/32 inch for 1/2-inch size; plus or minus 3/16 inch for sizes 5/8 inch to 1 1/4 inches; and plus or minus 1/4 inch for sizes 1 3/8 to 3 inches.

Bolts shall enter ring gage to head; ring gage shall have a maximum thickness of one diameter, a minimum fillet equal to the maximum fillet of the bolt, and an internal diameter equal to the specified maximum body diameter.

Suitable material for steel bolt is covered in Tentative Specification for Steel Machine Bolts and Nuts and Tap Bolts of the American Society for Testing Materials (ASTM A-307); suitable material for high-strength steel bolt is covered by ASTM Tentative Specification for Quenched and Tempered Steel Bolts and Studs with Suitable Nuts and Plain Washers (ASTM A-325).

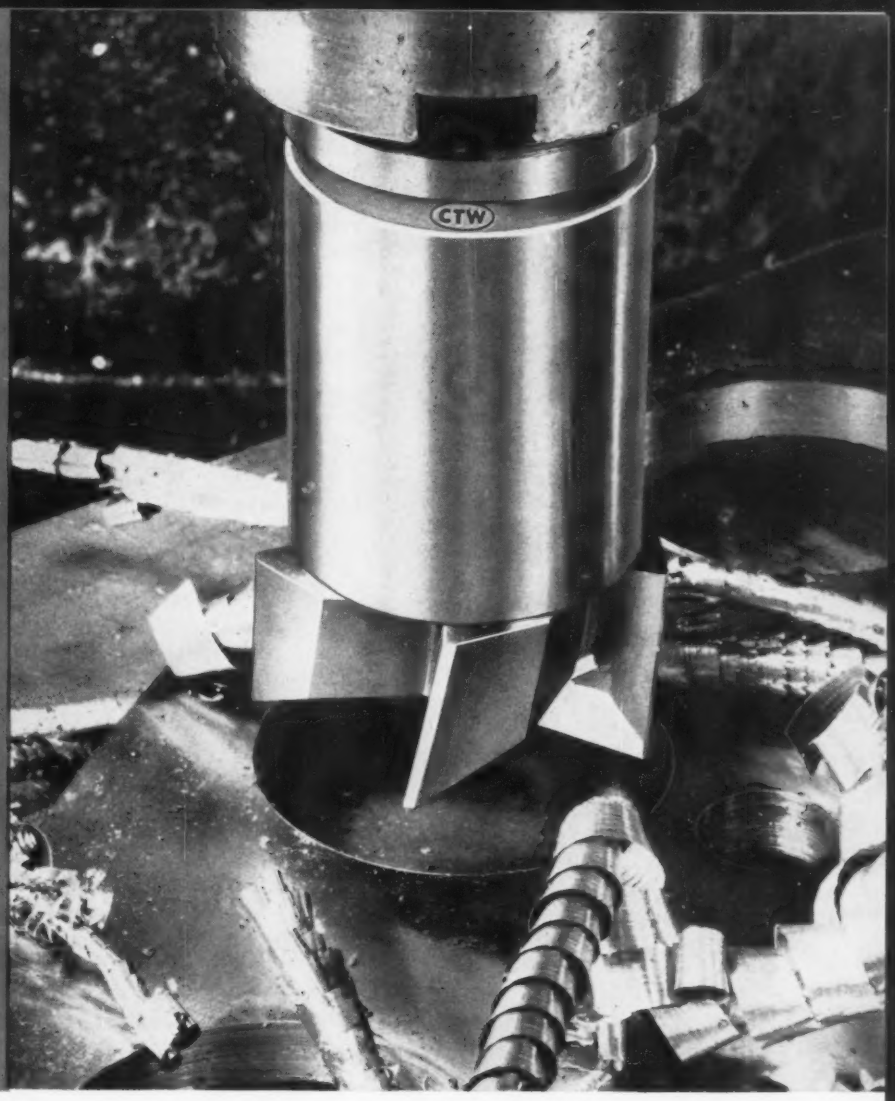
*There may be a reasonable swell or fin under the head or die seam on the body not to exceed the nominal body diameter by the following: 0.030 inch for sizes up to 1/2 inch; 0.050 for sizes 5/8 and 3/4 inch; 0.063 for sizes over 3/4 inch up to 1 1/4 inches; 0.093 for sizes over 1 1/4 inches up to 2 inches, 0.125 for sizes over 2 inches up to 3 inches; and 0.188 for sizes over 3 inches.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

EXHAUST FLOW
BEFORE
AFTER

CTW

Continental Counterbores may be purchased individually or in sets. Selection of three sets available.



After the heaviest cuts—they disengage with a twist of the wrist

Continental Counterbores are designed so that cutting torque produces compression rather than shearing stresses. This counterbore never binds—you get quick, easy disengagement after all cutting operations. Anti-wedging action saves time and tools.

Continental Counterbores have double driving lugs on the cutters which engage double abutments in the holders, making a single powerful tool out of the cutter and holder. Double bearings, one above and one below the lugs and close to the cutting edge, guarantee rigid alignment of holder and cutter.

For more information or literature on Continental Counterbores, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit.

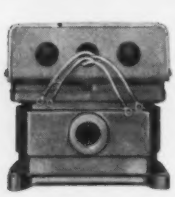
Continental **TOOL WORKS**

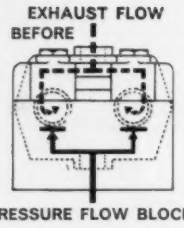
DIVISION OF

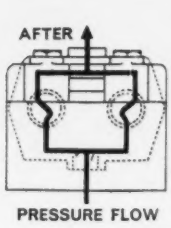
EX-CELL-O CORPORATION • DETROIT 32, MICHIGAN

56-61

No. 4—Air Clutch Press, Flywheel-type







ACTUALLY TWO MASTER VALVES IN ONE—interlocked pneumatically with common inlet and outlet ports. Diagrams show pressure flow *before* and *after* solenoids are energized. For double safety, solenoid control keeps press from starting—or will cause it to stop "safe"—unless both valves work simultaneously.

This double-solenoid safety valve makes

FEDERAL

air clutch presses

DOUBLY SAFE

Puts new GO in presswork!

Here is the answer to faster, safer, more economical production: the new Federal Air Clutch Press with double-solenoid control. Speeds may be increased without damage to work, without sacrificing precision. For the dual control gives you the protection you want—makes "repeats" due to valve failure *practically impossible.* Also operation is simpler—less fatiguing. Press may be "inched", single-tripped, or operated continuously. Available in sizes 6 to 100 tons. Prompt delivery on all models. *Write for new catalog showing complete line.*

FEDERAL PRESS COMPANY
701 Division Street, Elkhart, Indiana

FEDERAL *Open back Inclinable* PRESSES

32 Years of Quality Construction

materials at a temperature that probably never exceeds 150 degrees. The machine transforms the unworked material from its original form to the finished shape by the action of the forging elements. These elements apply controlled uniform circumferential pressure on the outside surface of the work, the pressure being increased at each stroke.

The process is best adapted for the production of cylindrical pieces having bores of close tolerances which require a high surface finish. A surface finish of 8 to 10 micro-inches is regularly obtained, although a finish of somewhat better than 2 micro-inches can be achieved. Tubular parts with a cylindrical outer surface but having a square bore or a bore with internal splines are relatively easy to make. Both ferrous and non-ferrous materials can be cold-formed by this process as long as the materials are ductile. Various types of carbon and alloy steels, as well as brass, bronze, aluminum, titanium, and stainless steels can be formed.

The No. 4 Fellows-Appel cold-forming machine consists of a forging unit joined to a unit which feeds the work into the forging dies. The forging dies are simultaneously forced onto the work in a direction radial to its center. The rate of feed is dependent upon the amount of deformation per stroke. The number of strokes, the feed, and the rate of rotation of the work are changeable. The selection of these is determined by the type and the physical properties of the material being formed, its dimensions, the required deformation, and the shape of the deforming section of the tool-set. Changes from one size of work to another can be easily and quickly accomplished.

Circle Item 145 on postcard, page 257

Hampton "Tru-Bor" Boring and Facing Machine

H. L. Hampton, Willow Grove, Pa., has brought out a precision boring and facing machine with push-button-actuated automatic controls. This machine, trademarked "Tru-Bor," is designed to finish instrument, electronic, and aircraft parts, housings, and castings with a high degree of accuracy. It will hold straight boring operations within accuracy limits of 0.0002 inch. Tolerances as close as 0.003 inch are attained under normal conditions when the work requires indexing of the cross-slide.

This compact machine measures 36 by 60 inches and weighs approximately 1200 pounds. It combines many unique features including the "Thy-Mo-Trol" drive, which is ready for action in sixty seconds; five-stop, electrically operated, cross-slide adjustments; and rapid traverse carriage action for longitudinal feed. In combination with the cross-slide, the tool can be set for three additional diameters or retracted speedily to the starting position. The stress-relieved, precision-machined front and rear castings of the machine rest on a black diabase plate that is flat within 0.00005 inch.

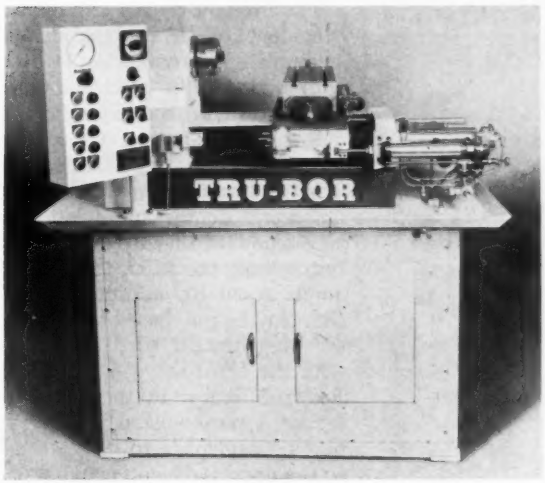
Circle Item 146 on postcard, page 257

Hommel Profile Grinder and Larson Precision Grinder

The Aaron Machinery Co., Inc., New York City, is introducing in this country the German-made Hommel optical profile grinder shown in Fig. 1. This machine is designed for grinding profile gages, circular form tools, straight form tools, press tool punches (with and without flanged foot), press tool dies with clearance angle, cams, and many types of profile tools, work-pieces and gages. It also checks the profiles.

An outline of the profile to be ground is drawn with India ink on a transparent plastic sheet in the selected enlarged scale within the range of 10 to 1 and 50 to 1. This drawing is placed on the projection table, and the profile of the work is ground to match it. The projection screen shows in sharp focus a portion of the profile drawing, the corresponding section of the work-piece, and the cutting edge of the wheel.

By means of two control levers,



"Tru-Bor" boring and facing machine brought out by H. L. Hampton

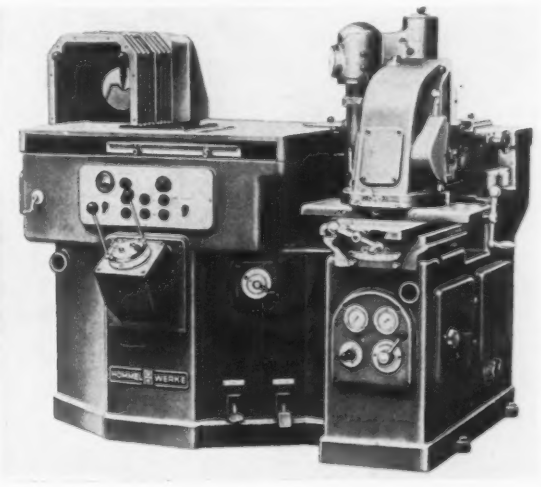


Fig. 1. Hommel profile grinder introduced by the Aaron Machinery Co., Inc.

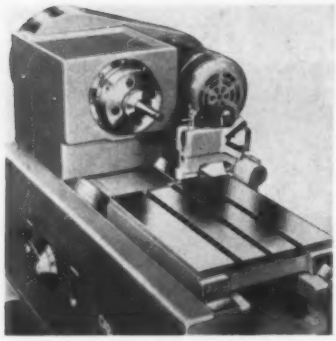


Fig. 2. Larson boring machine marketed by Aaron Machinery Co., Inc.

the projection table (with the drawing) is moved hydraulically, the outline of the profile being guided so that it maintains contact with the image of the grinding wheel, which serves as a guide. The movement of the projection table is transmitted to the work-table through a lever system. The ratio is set by means of gage-blocks to insure high precision.

The Aaron Machinery Co., Inc., is also introducing from Sweden the Larson precision boring machine shown in Fig. 2. A new technical development incorporated in this machine permits the adjustment of boring cutter to be read directly on a dial indicator within an accuracy of 0.001 inch. This single-ended, precision boring machine has a wide capacity range and is easily operated.

Circle Item 147 on postcard, page 257

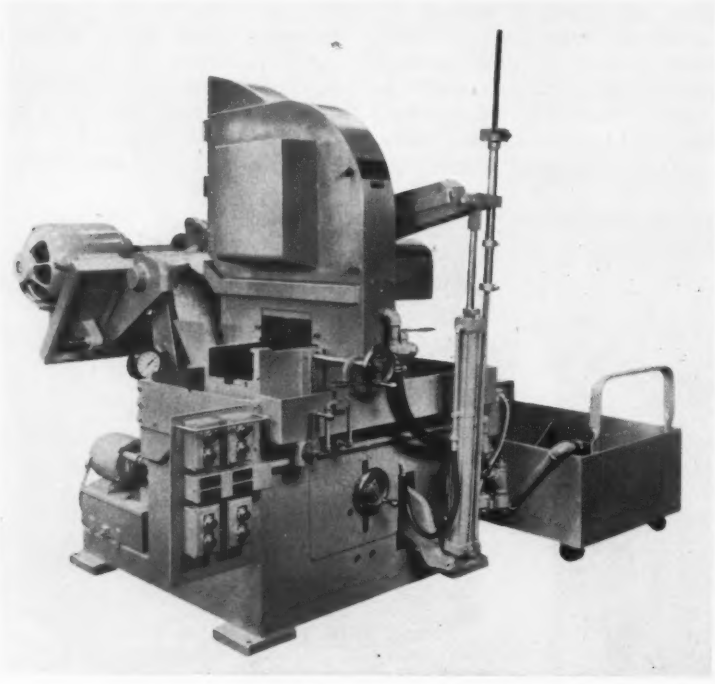
Wet-Abrasive Cutting Machine

A Model 481 wet-abrasive oscillating-wheel machine for cutting large-diameter bar stock, tubing, and other shapes of both ferrous and non-ferrous metals, including corrosion-resistant steel as well as hardened or annealed steels, is being manufactured by the Campbell Machine Division, American Chain & Cable Co., Inc., Bridgeport, Conn. This machine is designed for use in metalworking shops, factories, railroad shops, foundries, and maintenance shops. It is equipped with an Allison abrasive cutting wheel 26 inches in diameter and will cut practically any metal within its rated capacity of 8-inch-square solids.

The wheel feed and work clamps are hydraulically operated, and the work bar is hand fed. Through its oscillating motion, the amount of abrasive wheel contact is materially reduced, and cutting is performed with a minimum of wheel pressure.

An adjustable coolant box assures thorough and equal wetting of both sides of the abrasive wheel and guidance of coolant directly to the critical cutting area. The abrasive wheel is driven by a 25-H.P., totally enclosed, fan-cooled motor. All interior parts are cadmium-plated to prevent rust. The unit is 100 inches long, 85 inches wide, 84 inches high, and weighs approximately 6800 pounds.

Circle Item 148 on postcard, page 257



Abrasive cutting machine made by Campbell Machine Division, American Chain & Cable Co., Inc.

Brown & Sharpe Apprentice Tool Chest

Apprentice Tool Chest

The Brown & Sharpe Mfg. Co., Providence, R. I., has introduced a complete Apprentice Tool Chest with high-quality precision tools selected to meet the requirements of the average apprentice in the metalworking trades. The chest is made of durable oak, with drawers of several depths and widths to accommodate the original set of twenty-one precision tools, plus ample room for additional tools that may be purchased later.

A registration card furnished with the chest may be mailed to Brown & Sharpe by the owner to secure a personalized, engraved, chrome nameplate to be attached to the chest for identification.

Circle Item 149 on postcard, page 257

(This section continued on page 246)

LONG processing time is cut SHORT . . . on the *New Electrically Operated* KING

INTERDEPARTMENT MEMO
To – Scheduling
From – Expediting

OK to re-route #23. Bob gets all his jobs through faster now with that new King
Pete

Whether you set up on a long production run or a single "maintenance" job, you can *finish it better, faster, and at lower cost* on an all-new KING® Vertical Boring and Turning Machine.

. . . because the new KING has *Full Electrical Operation* — with all controls conveniently located:

☆ ***YOU CUT CONTROL MANIPULATION TO A BARE MINIMUM AND SPEED SET-UP TIME.***

. . . because the new KING is *Powered for Productivity* — 40 to 50 H.P. on 30", 36", and 46" sizes; 75 to 100 H.P. on sizes 56" and up:

☆ ***YOU CAN OPERATE THE MOST ADVANCED MODERN CUTTING TOOLS TO THEIR FULLEST CAPABILITIES.***

. . . because the new KING has *Expanded Feed and Speed Ranges* — 24 pre-selective feeds from .0016 to .250 per revolution . . . 24 pre-selective speeds in any one of three standard ranges:

☆ ***YOU GET REQUIRED FINISH AND SPECIFIED TOLERANCES ALL THROUGH THE SET-UP.***

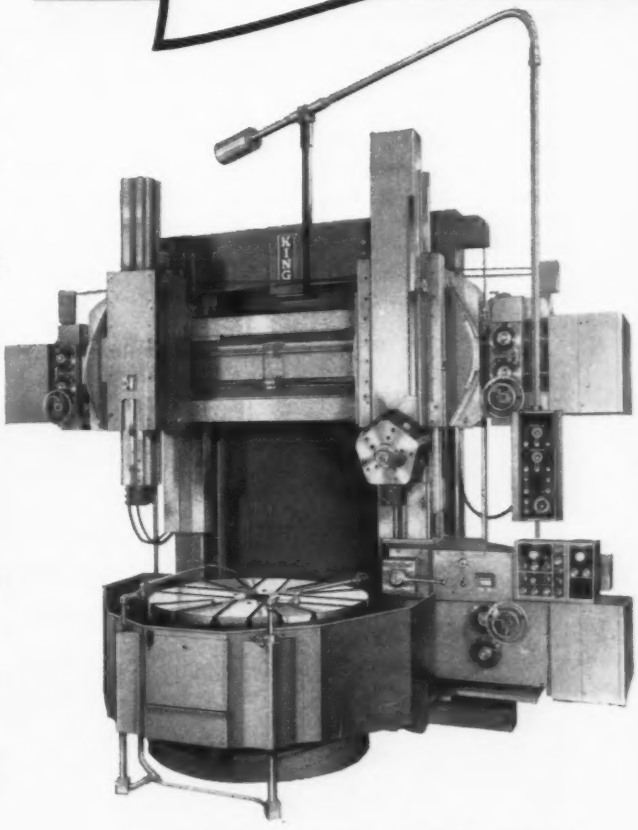
. . . because the new KING has an outstandingly improved spindle and spindle mounting:

☆ ***YOU GET MAXIMUM TABLE STABILITY WITH RESULTANT INCREASED AND UNIFORMLY MAINTAINED ACCURACY.***

. . . because the new KING is readily adaptable for addition of Optional Features such as *Automatic Cycling, Automatic Positioning of Heads, Automatic Tracing Control of Heads, Power Rail Clamping,* etc.:

☆ ***YOU HAVE BROADER TOOLING VERSATILITY FOR ATTAINING EXTRA-FAST AUTOMATED PRODUCTION AT MINIMUM COST.***

For complete details on the All-New KING Machines see the KING Distributor in your area or write us.



Machine illustrated is a 56" size with Ram Head and Turret Head on Rail, Side Head, and Coolant Pan. The New King Machines are available in sizes 30", 36", 46", 56" and up, in a wide variety of head combinations, with or without side head.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

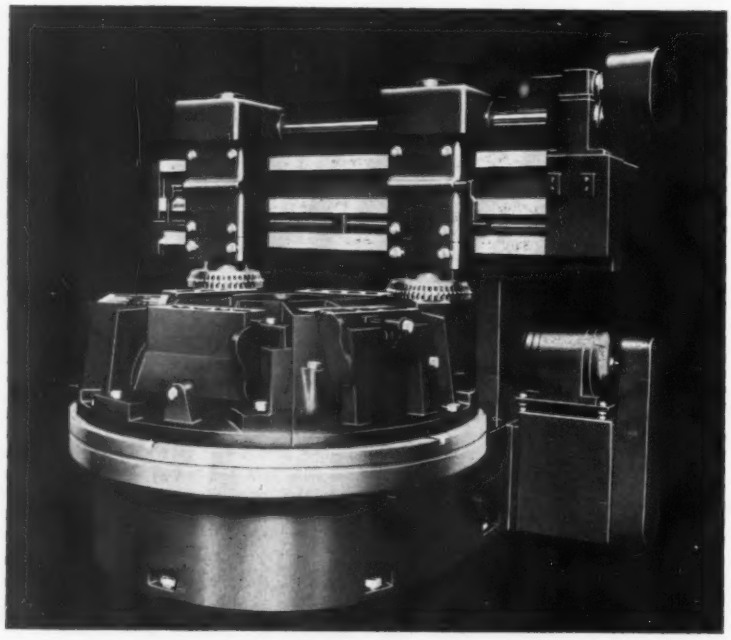
KING Vertical Boring and Turning Machines

Niles Rotary Milling Machine

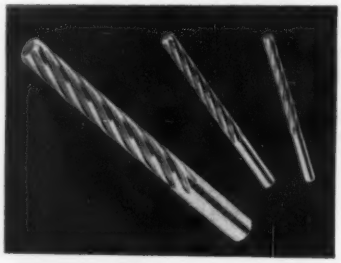
A Niles continuous, rotary milling machine with a circular table and twin spindles designed for high-production work in the automotive industry has been developed by the Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. This machine is of box type construction, with columns and cross-rail cast integral and bolted to the bed for rigid application of the cutters to the work. The work is hand-clamped or—with optional equipment—held and released automatically. It is fed continuously to the milling cutters in multiple setups. The finished work can be taken off the table and new work put on while the table is moving and the cutters are operating.

The spindle heads are independently adjustable vertically and horizontally, enabling the operator to rough-cut in one pass, with one cutter and, at the same time, finish with the second, or to rough or finish on two levels in two different cutting circles. The table is 72 inches in diameter, has a variable-speed power drive, and rides on anti-friction bearings. It can be set for speeds up to 100 inches an hour. While intended primarily for the automotive industry, this rotary miller is adaptable to other fields, specifically in the aircraft industry.

Circle Item 150 on postcard, page 257



Niles rotary milling machine developed by the Hamilton Division, Baldwin-Lima-Hamilton Corporation



Drill-length reamers made by Ace Drill Corporation

Ace Drill-Length Reamers

The Ace Drill Corporation, Adrian, Mich., is offering a complete line of drill-length reamers in standard sizes ranging from 1/16 to 1/2 inch in diameter by steps of 1/64 inch. These reamers are recommended for machining ferrous materials on drill presses or automatics. They are made of pre-hardened high-speed steel and produced by the ground-from-the-solid process within tolerance limits of +0.0002 and −0.0000 inch for use on close precision work.

The flutes of these reamers are nearly twice the length of regular chucking reamers. This allows for frequent grind backs. Special diameter drill-length reamers made from high-speed steel drill blanks can be readily supplied in sizes from 0.040 to 0.500 inch.

Circle Item 151 on postcard, page 257

Armored porous tubing encases the Silvium grid spines and active material of the positive plates in TG Exide-Ironclad Giant batteries

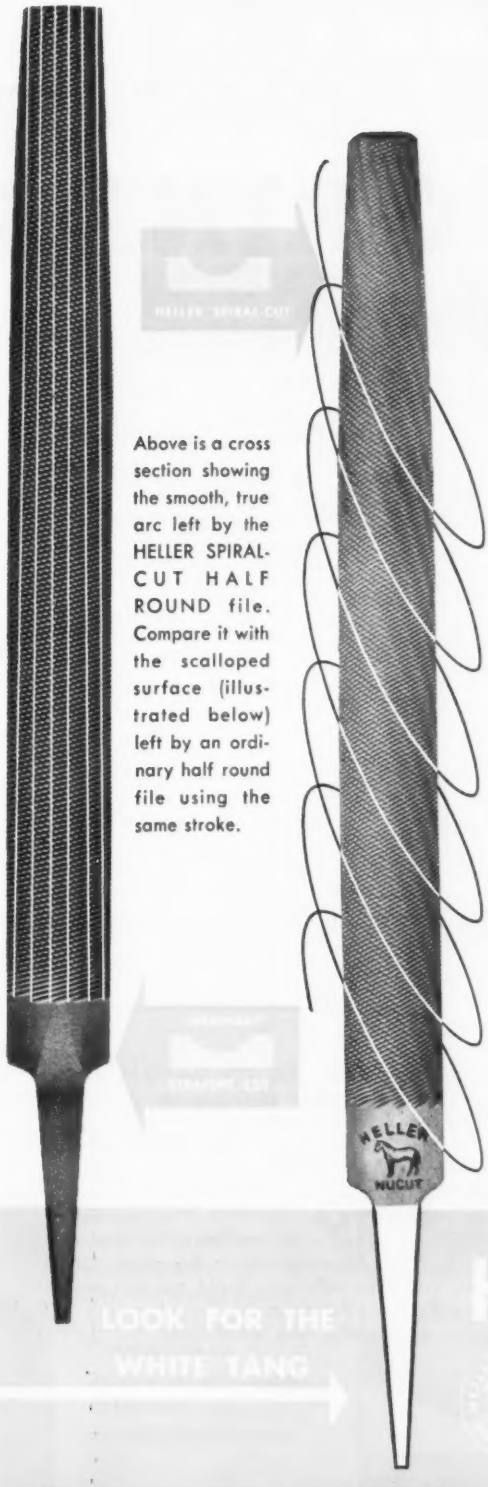
Exide Battery Capacities Boosted

An increase of 44 per cent in the rated capacity of Exide-Ironclad motive power batteries has been announced by the Exide Industrial Division of the Electric Storage Battery Co., Philadelphia, Pa. This has been facilitated by a new type of armored porous tubing to encase the grid spines and active material of the positive battery plates. The fact that more power has been packed into the same battery-cube space is a major improvement for electric industrial trucks.

Perforated polyvinyl chloride tubing, lined with braided, continuous filament glass, is used. The tubing is highly permeable to the diffusion of electrolyte and the passage of current. However, it is said to prevent practically any loss or shedding of active material. The TG Exide-Ironclad Giant batteries have a rated capacity of 72 ampere-hours per positive plate and are available with capacities ranging from 360 to 1152 ampere-hours at the 6-hour discharge rate.

Circle Item 152 on postcard, page 257

The Rolling Action is built right in



Above is a cross section showing the smooth, true arc left by the HELLER SPIRAL-CUT HALF ROUND file. Compare it with the scalloped surface (illustrated below) left by an ordinary half round file using the same stroke.

HELLER Spiral-Cut half round files

Filing out a concave surface or rounding out a hole is no longer a job restricted to master craftsmen. HELLER SPIRAL-CUT HALF ROUND files eliminate the need for skillful twisting action once so necessary to produce smooth, even work. This rolling action is now designed right into a HELLER SPIRAL-CUT HALF ROUND file.

A straight stroke with an ordinary half round file leaves bumps and ridges unless the user twists it just right. The same straight stroke with a HELLER SPIRAL-CUT HALF ROUND makes a smooth and true-arc surface.

Everyone gets perfect results with this new SPIRAL-CUT, an *exclusive* feature of HELLER HALF ROUND files. This new cutting principle is another of many "firsts" brought out by HELLER in their continuous search for a better file.

these brands always assure HELLER quality

HELLER *American-Swiss*® SWISS PATTERN

VIXEN® MILLED CURVED TOOTH

NUCUT® AMERICAN PATTERN

LOOK FOR THE WHITE TANG

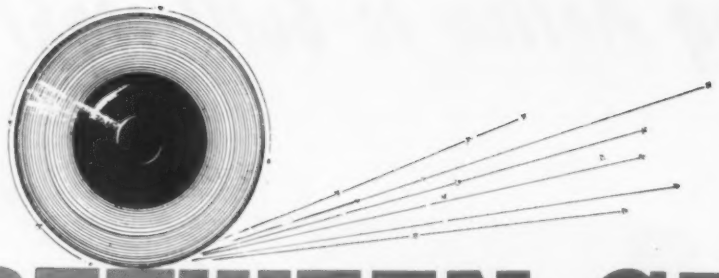
HELLER TOOL CO.

A subsidiary of Simonds Saw and Steel Company

NEWCOMERSTOWN, OHIO

Branches: New York, Detroit, Chicago, Los Angeles

YOUR *HELLER* DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS



By E. S. Salichs

BETWEEN GRINDS

The Pipe is Ripe

In *The New York Times* appeared the dramatic story of firemen attempting to thread a string through a 730-foot length of pipe irregularly laid under the New Jersey Turnpike, in order to get a wire through for a fire alarm system. They failed with rats who died en route, and with other means, so a railroad man owning a pet mongoose named Pop offered Pop's services, because he had achieved a trial run while chasing one of the rats. Pop was harnessed and, carrying a string, inserted in the pipe. He, also, refused to cooperate. In the meantime, an interested public, including engineers, offered other suggestions—an electric mouse; a ball-and-pressure technique; a rodding method; and even a large beetle with butter on its nose.

Motor Mite

A servo motor, made by the Ford Instrument Co., weighs under one ounce and is termed "subminiature." So many things being super, it's novel to hear about sub.

New Trick for Tick—and Tock

The mainspring was eliminated from the wrist watch, an electric one, ushered in by the Hamilton Watch Co. after ten years of research. The electric watch operates on chemical energy stored in a tiny Energizer, and runs without winding or periodic agitation. A time-saving timekeeper! The mainspring, we learned, has been an integral part of portable timekeeping devices since it was invented in 1480 by Peter Henlein, of Germany. So that's why our watchmaker always looked mournfully over his glass at us as he remarked, "It's the mainspring."

Case or Casing History

A paper-back with a lurid cover entitled "Murder in the Model Shop," having the sub-title "A gripping novel of suspense and violence as a stalwart band of engineers face the crossroads," was recently placed on our desk. Required reading? We settled down to make the best of it, but no blood was shed, no corpse uncovered. On the contrary, the story simmered down to the solution of an actual production problem by the use of a Servoboard electro-mechanical assembly kit. But the description of Miss Demeanor, a laboratory assistant—oh, *that* was the gripping part. Sorry.

IN ONE EAR AND OUT TO THE TAPE RECORDER—Pretty Peggy McQueen is demonstrating here how the new suggestion plan system at the General Electric Co., Schenectady, N. Y., works. Peggy, a G-E employe, is murmuring her bright idea into the paper ear, golden in color (signifying, no doubt, that suggestions pay off), containing a microphone which relays her voice to a tape recorder in the offing. Of course, employes with mike fright can still use the card system. But given the "now hear this" opportunity, who could resist?

dixi 60

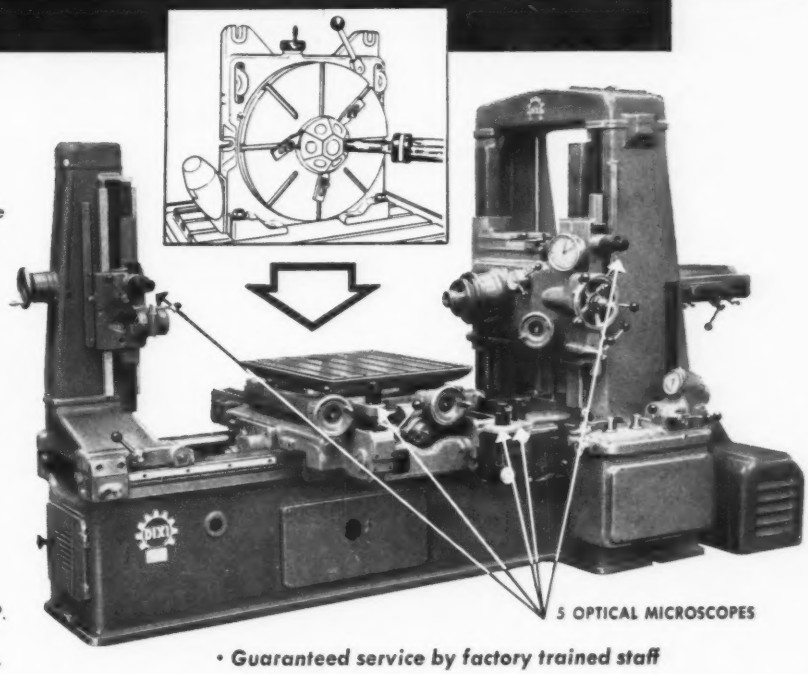
horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

ACCURACY
Overall accuracy of .0002"



A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝" All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.

- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
- ***Spare Parts in New York stock***
- ***Your operators trained***

DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

MBI

Our Headquarters in New York City

M.B.I.

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A Division of Machinery Builders, Inc.

475 Grand Concourse, Bronx 51, N. Y.

Over 20 years experience in designing & building machinery

Phone: MOtt Haven 5-0900

News OF THE INDUSTRY

Illinois, Wisconsin, and Iowa

CHICAGO-LATROBE TWIST DRILL WORKS, Chicago, Ill., announce the following appointments: MALCOLM ONWOOD has joined the company's Eastern staff covering the central Connecticut territory. RAUL RANGEL will serve as sales and field representative in the Southern California territory.

ACME STEEL CO., Chicago, Ill., announces the appointments of BARTLETT RICHARDS as vice-president and presidential assistant, HARRY R. SANOW as vice-president of Riverdale operations, and JOSEPH H. MYERS as general superintendent of the Riverdale Plant.

CRANE PACKING CO., Morton Grove, Ill., has purchased and put into almost immediate operation a 30,000-square-foot, one-story plant in Vandalia, Ill. This plant is being used to augment the company's home plant facilities.

DAVID MEYER has been appointed sales engineer for the Illinois Tool Works, Chicago, Ill. The principal cities and industrial areas in Mr. Meyer's territory are Indianapolis, Evansville, Terra Haute, and Kokomo, Ind., and Louisville, Ky. In his new position, Mr. Meyer succeeds RAY BLAKEMAN, who has been promoted to an executive position in the Tool & Machine Division at the company's headquarters in Chicago.

BARBER-COLMAN CO., Rockford, Ill., announces the appointment of PETER R. NOLING as sales representative for the Machine & Small Tool Division in southern California. Mr. Noling will handle the complete line of hobbing and sharpening machines, hobs, milling cutters, and reamers. His office will be located at 7451 E. Slauson Ave., Los Angeles, Calif.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the following sales management appointments at its Detroit and Chicago plants: SCOTT VROOMAN has been named sales manager in Detroit. BRUCE D. CLAUSONTHUE has become sales manager in Chicago, replacing Mr. Vrooman. Mr. Vrooman had been a member of the Chicago plant organization since 1936, and became sales manager in 1956. Mr. Clausonthue joined the company in Chicago in 1946. He entered the sales department the following year, and in 1949 he was appointed a field representative. CLIVE C. EARLE was appointed manager of alloy and stainless-steel sales at the company's Pittsburgh, Pa., plant. L. PAUL LEE has been named manager of stainless-steel sales at the Milwaukee, Wis., plant.

(Left) Scott Vrooman, sales manager, Detroit, and Bruce D. Clausonthue, sales manager, Chicago, for Joseph T. Ryerson & Son, Inc.

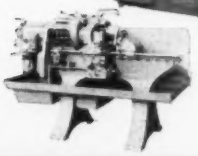
VERSON ALLSTEEL PRESS CO., Chicago, Ill., announces the following executive appointments: REAR ADMIRAL WILLIAM O. GALLERY, U. S. Navy (Retired), has been named vice-president—administration. Prior to assuming his duties with Verson, Admiral Gallery had been thirty-five years in the Navy, twenty-five of which were devoted to naval aviation. MELVIN D. VERSON has been appointed vice-president—marketing. He has been with the company since

(Left) Rear Admiral William O. Gallery, vice-president—administration, and Melvin D. Verson, vice-president—marketing, Verson Allsteel Press Co.

GREENLEE

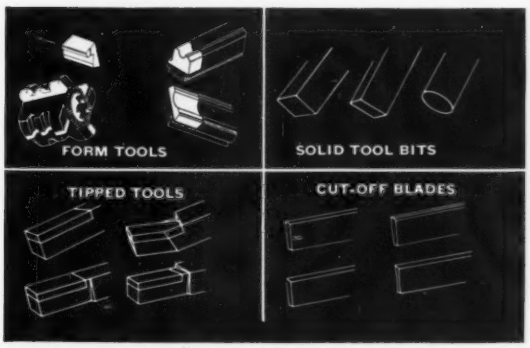
WARNER & SWASEY

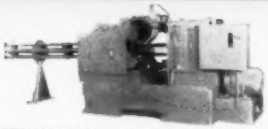
BROWN & SHARPE



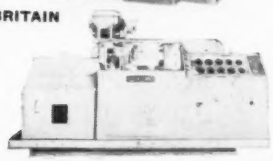
BARDONS & OLIVER

How to Reduce Costs by Tooling Automatics with V-R TANTUNG Cast Alloy

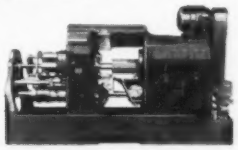




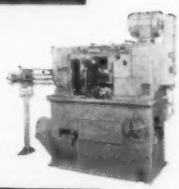
NEW BRITAIN



CLEVELAND



ACME-GRIDLEY



CONOMATIC

TANTUNG is a natural for single point and form tools for automatics, *particularly on short runs.* It is an exclusive chill cast alloy containing carbides of tungsten, tantalum and columbium—has high red hardness . . . low coefficient of friction . . . and high transverse rupture strength. It offers these cost-saving advantages:

1. ***Lower Grinding Cost.*** Tantung is easy to grind straight or to form. You do not need diamond wheels. Aluminum oxide wheels, such as used for hardened steel, are suitable. This feature effects major savings over carbide tools for short runs.

2. ***Lower Tool Cost.*** Tantung is available in solid tool bits, permitting many more regrinds than are possible with a brazed tip tool.

3. ***Higher Production.*** Tantung permits cutting speeds at least 50% higher—and up to 100% higher—than those possible with high speed steel.

4. ***More Efficient at Moderate Speeds.*** Tantung tools operate successfully at speeds too slow for efficient use of carbide and too high for HSS. They are ideal on multiple tooling setups where surface speeds of one or more operations fall below the carbide cutting range.

5. ***Available Cast-to-Form.*** By specifying preformed Tantung, you reduce grinding costs and secure longer tool life.

Whenever you are tooling automatics,
it pays to keep Tantung in mind.

SEND FOR FREE BOOKLET:

"Where and How to Use Tantung", a new booklet just off the press, gives complete information about Tantung—describes its characteristics . . . tells how to grind and braze it . . . explains the cost-saving advantages of specifying it cast-to-form . . . shows cutting speed ranges . . . describes multiple tooling setups . . . shows how it gets more work out of older machine tools that can't handle carbides. Send for your free copy, without obligation.

Tantung and V-R are registered trademarks of Vascoloy-Ramet Corporation

T-608

Vascoloy-Ramet Corporation

862 Market Street, Waukegan, Illinois

1950 and recently has been serving in the capacity of assistant to the president.

LINK-BELT CO., Chicago, Ill., announces the following changes in its district office sales organization: GEORGE A. MOST, JR., has been appointed district manager for Boston; J. CHARLES BULLOCK, district manager, Moline; GENE A. ZWERNER, district manager, Albany; C. C. Wiley, district manager, Washington, D. C.; and PAUL WALDORF, district manager, Baltimore.

ANDREW L. ROWE has been appointed assistant to the president of LaSalle Steel Co., Chicago, Ill. Mr. Rowe was formerly a vice-president of the Elgin National Watch Co. with whom he had been associated for twenty-two years. At the same time, announcement was made of the promotion of THOMAS J. MOORE, JR. to the post of director of product planning and diversification.

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis., announces the following appointments: ERWIN J. KAISER, currently general manager of the Davis Boring Tool Division, has been named staff vice-president—manufacturing of Giddings & Lewis Machine Tool Co. Succeeding Mr. Kaiser as general manager of the Davis Boring Tool Division is GEORGE K. CASSADY who is presently the sales manager of the G & L and Hypro division. Taking over as sales manager of the company's Hypro Division is GUY E. LINGENFELTER, who is now the assistant sales manager of the division.

Morris L. Hutchens, vice-president in charge of engineering, at the Kearney & Trecker Corporation

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis., announces the election of MORRIS L. HUTCHENS as vice-president in charge of engineering. Mr. Hutchens has been with the company since 1939 and was employed as a sales engineer for ten years; after that he served as chief engineer of special machinery. At the same time it was announced that HERBERT WHITNEY was named chief metallurgist, and CHARLES PARSKE chief engineer of the general engineering department.

BOYD S. OBERLINK, group vice-president of Allis-Chalmers Mfg. Co., Milwaukee, Wis., was elected to the firm's board of directors. Prior to his present appointment, he was vice-president and general manager of the Construction Machinery Division. Two other officers were appointed: ARCHIE D. DENNIS, assistant secretary and assistant treasurer, and PICKENS JOHNSON, assistant secretary.

RAY DOLLAR has been named a representative for the Warner Electric Brake & Clutch Co., Beloit, Wis. Mr. Dollar has been assigned to the Florida and southern Georgia area and will work out of Atlanta with headquarters at 3275-C Roswell Road, N. E.

GLOBE MACHINERY & SUPPLY CO., E. 1st and Court Sts., Des Moines, Iowa, has been appointed exclusive distributor for the Iowa area by Greaves Machine Tool Co., Cincinnati, Ohio, a division of J. A. Fay & Egan Co.

Michigan and Indiana

ROBERT C. MCCARTNEY has been appointed sales and engineering representative in the Pittsburgh area for the Michigan Tool Co., Detroit, Mich. Mr. McCartney will represent the complete line of the company's machine tools and cutters.

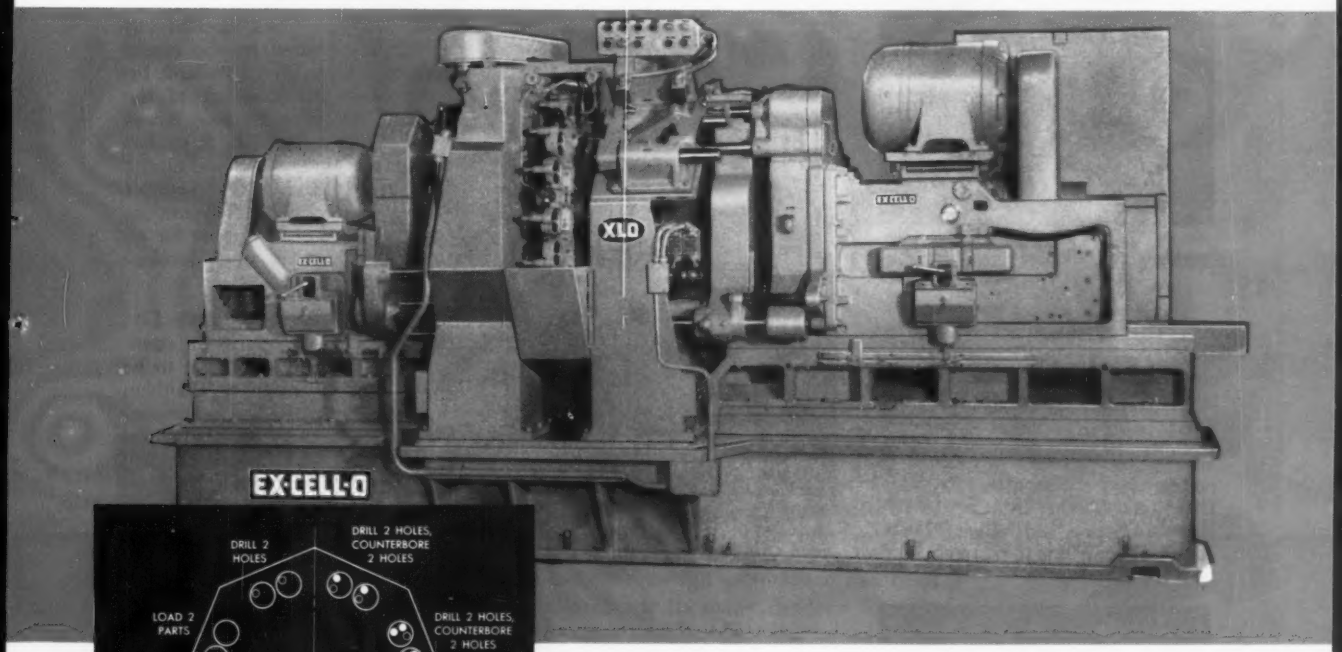
E. A. ROLF has been appointed sales engineer at the Detroit, Mich., office of R. K. LeBlond Machine Tool Co. Mr. Rolf has been with the company since 1940.

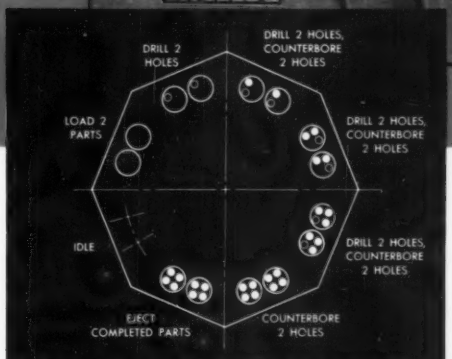
MANUEL F. DIAZ has been elected president of Wesson Tool Co., Ferndale, Mich. Mr. Diaz replaces ERNEST MORTENSEN, who recently re-

(Left to right) Erwin J. Kaiser, staff vice-president—manufacturing of Giddings & Lewis Machine Tool Co.; George K. Cassidy, general manager, Davis Boring Tool Division; and Guy E. Lingenfelter, sales manager of the G & L and Hypro Division.

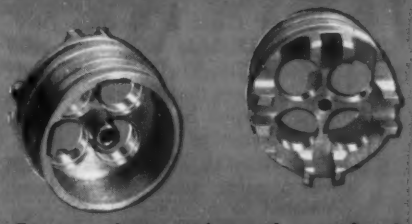
SPECIAL EX-CELL-O MACHINE

Drills and Counterbores 514 Rocket Nozzles per Hour





This diagram shows the progressive operations. At station 7, parts are automatically ejected.



Front and rear view of completed part. The rocket nozzle is tough forged steel; location of holes to each other and to the four pronged slots is critical.

Here's another Ex-Cell-O solution to a hard-to-handle machining job. Rocket nozzles are small, tough steel forgings. For the drilling and counterboring operations—shown in diagram—critical dimensions must be held.

Ex-Cell-O designed and built this special machine with a trunnion fixture that indexes through eight stations. Two Standard Ex-Cell-O Slide Type Hydraulic Power Units—one for drilling, the other for counterboring—actuate the multiple spindle heads. Features of the machine include simplified design, high productivity, safety and sturdiness. . . . When you're faced with a tough machining problem, call in Ex-Cell-O.

XLO
EX-CELL-O for PRECISION

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

36-28

Manuel F. Diaz newly elected president of Wesson Tool Co.

tired after fifty years in the cutting tool industry. Mr. Diaz joined the company in 1937, was elected assistant secretary-treasurer in 1940, and was later named vice-president.

JACK L. MUSTARD has been appointed sales manager, Industrial Division, Ex-Cell-O Corporation, Detroit, Mich. Mr. Mustard will continue to work with the company's

Jack L. Mustard, sales manager, Industrial Division, Ex-Cell-O Corporation

industrial representatives, both in the Detroit area and in the national sales organization. He has been with the company since 1940.

MOBILE DRILLING, INC., Indianapolis, Ind., has purchased the Earth Drill business of the Buda Division of Allis-Chalmers Mfg. Co. Inventories are being moved to the Mobile Drilling plant in Indianapolis. No other products of the Buda Division or of Allis-Chalmers Mfg. Co. are involved in this transaction.

New England

DAVID W. MYERS, vice-president and controller of the Producto Machine Co., Bridgeport, Conn., has

David W. Myers, vice-president, controller, and member of the board of directors, Producto Machine Co.

been elected to the company's board of directors. Mr. Myers, who has been associated with the company for the past sixteen years, had been controller since 1953 and was named vice-president last year.

JOHN A. COE, president of the American Brass Co., Waterbury, Conn., has been elected to the board

John A. Coe, member of the board of directors of Bullard Co.

of directors of the Bullard Co., Bridgeport, Conn. Mr. Coe began his business career in 1920 in the production operations of American Brass Co. Transferring to the sales department in 1928, he became general sales manager in 1936. Advancing in the company's executive organization, he became president in 1950. He also serves as chairman of the board of Anaconda American Brass, Ltd. Mr. Coe's election fills the vacancy created by the recent death of Joseph W. C. Bullard, retired former vice-president of the company. At the same time it was announced that JOHN P. POTH has joined the company, and will fill the newly created position of director of engineering. In his new position, Mr. Poth will be responsible for all product engineering and development.

JONES & LAMSON MACHINE CO., Springfield, Vt., announces the opening of a Boston district office to be located at 751 Main St., Waltham 54, Mass. This office will be responsible for the sales and service of the company's machine tools and optical comparators in Massachusetts, Rhode Island, and Connecticut, with the exception of Fairfield County and part of New Haven County. Vermont and the portion of New York State including the Schenectady area and the eastern counties north of Schenectady will also be handled by the new office.

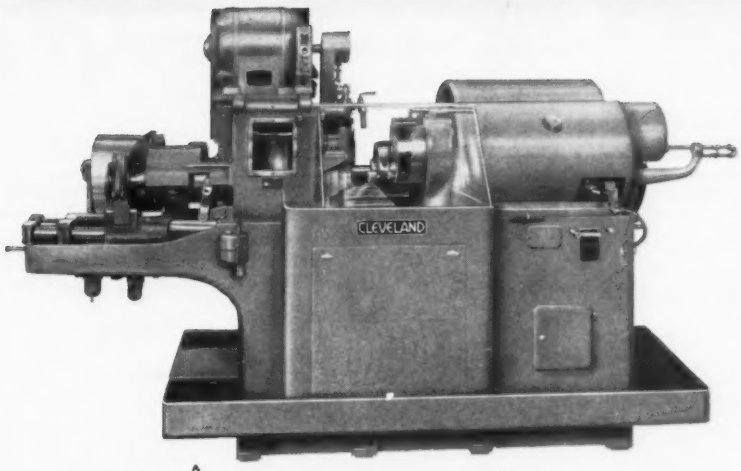
CONE AUTOMATIC MACHINE CO., INC., Windsor, Vt., has formed a new division to handle engineering and sales for the Pilot automatic copying lathe. Headquarters of this Pilot Division will be in the company's New York office at 30 Rockefeller Plaza. The Division's activities will be supervised by J. A. GERARD, first vice-president of Cone Automatic.

BRYANT GAGE & SPINDLE DIVISION, a Division of the Bryant Chucking Grinder Co., Springfield, Vt., announces that the gage section of the Division has been moved to larger quarters to facilitate manufacturing. RUSSELL P. SCHOLL, former division sales manager, has been promoted to manager of the gage section and HESSLER GATES, JR., has been appointed chief of engineering and production.

CURTIS D. CUMMINGS has been appointed sales manager of the Campbell Machine Division, American Chain & Cable Co., Inc., Bridgeport, Conn.

(This section continued on page 262)

new CLEVELAND
2½" MODEL "AW" SINGLE SPINDLE AUTOMATIC



CUTS YOUR COSTS 3 WAYS!

More than 65 years of automatic screw machine design experience has been engineered into this new Model "AW" Cleveland. Its many modern features will enable your shop to set new economy records for fast, accurate production of turned and formed parts . . . *and you save three ways:*

YOU SAVE ON BASE PRICE

Your savings start at the *first* cost, as the 2½" Model "AW" is offered at a base price of $3500 to $4000 *less* than other comparable automatics!

YOU SAVE ON SET-UP TIME

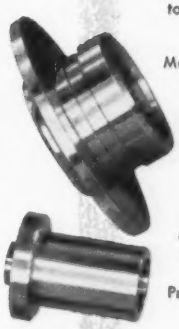
Such features as universal camming . . . rapid hand crank stock feed adjustment . . . quick change collet pads . . . maximum accessibility for tooling . . . make this Cleveland *quick* to set-up and exceptionally economical to operate. Spindle speeds range from 69 to 1920 rpm, providing efficient cutting speeds for all types of materials and tools. Four full automatic speed changes are available. Gear changes are quickly made.

YOU SAVE ON MAINTENANCE AND FREEDOM FROM DOWNTIME

Simplicity is the keynote of this Cleveland design. Completely free from complex mechanism and controls requiring constant attention or adjustments, this rugged, *fool-proof* automatic will assure the user dependable day-in, day-out performance!

To find out how much this new Cleveland can save you on your parts production, ask your Cleveland representative to submit a cost proposal with production estimates based on prints or samples of your work. There is no obligation.

Several examples of typical Model "AW" production are shown here. Note the profitable production rates—the variety of operations performed with simple tooling.



Material: 24ST Aluminum
Operations: Drill (2); C'bore; Ream; Face; Form (2); Cut-off.
Production: 62 pieces/hr.

Material: SAE 2317
Operations: Drill (2); C'bore; Tap; Face; Form (2); Cut-off.
Production: 41 pieces/hr.

Material: FM Brass
Operations: Drill (2); Thread; Bore; Form; Knurl; Cut-off.
Production: 110 pieces/hr.

Material: SAE 4615
Operations: Turn; Form (2); Thread; Center; Face; Chamfer; Cut-off.
Production: 36 pieces/hr.

Material: 24ST Aluminum
Operations: Drill (2); C'bore; Chamfer; Face (2); Form (2); Cut-off.
Production: 80 pieces/hr.

Write for this new bulletin for full details on the 2½" Model "AW" Cleveland

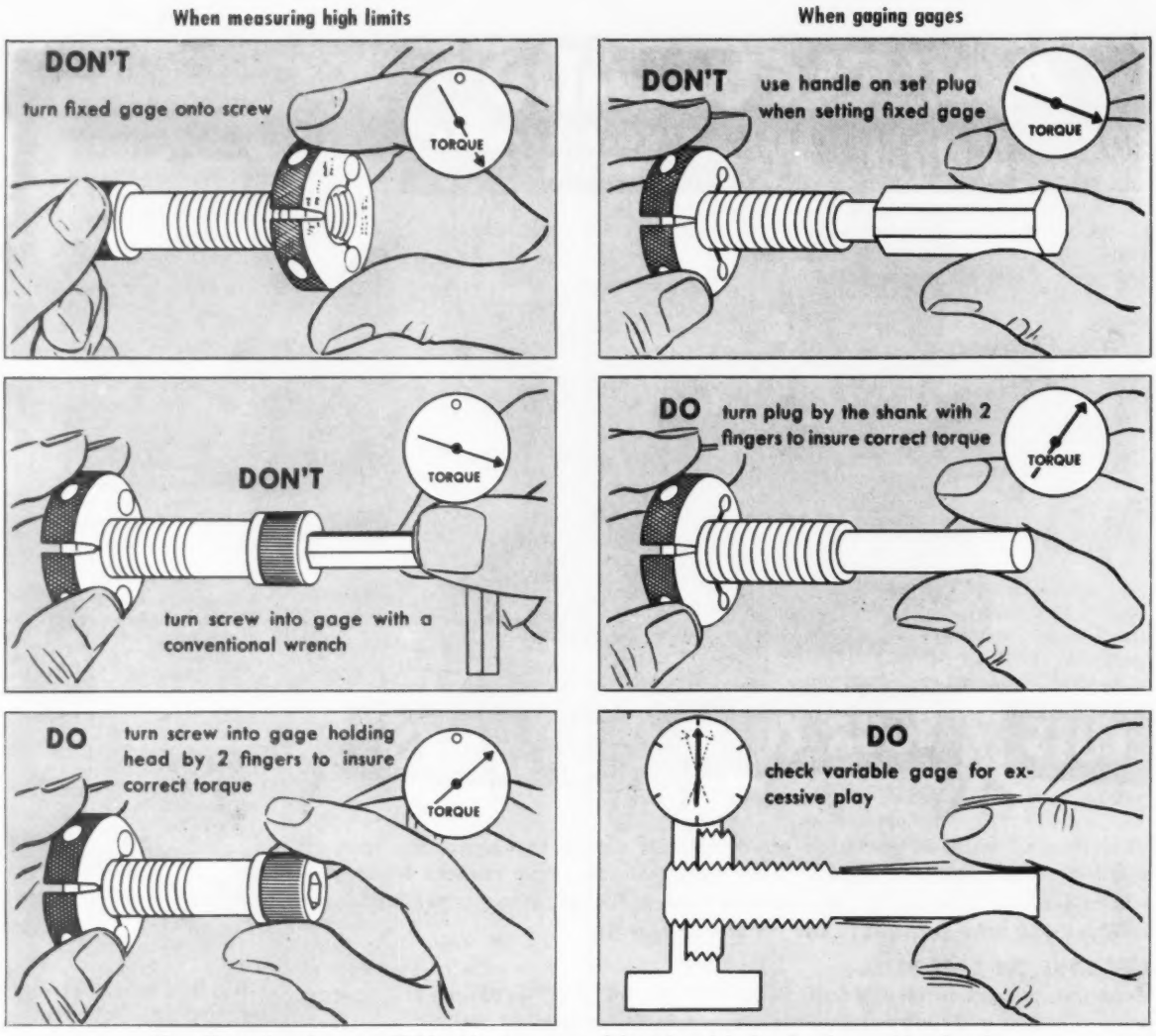
Remember: *Clevelands Cut Costs*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

For more information fill in page number on Inquiry Card, on page 257



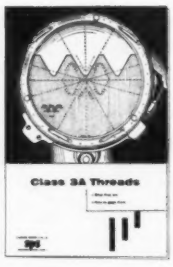
These illustrations from new SPS booklet show some of the do's and don'ts of gaging precision threads.

3A threads: what they are; how to gage them — new SPS booklet tells all

Threads made to Class 3A fit are the most precise in general use in industry. But you do not always get the 3A precision you specify. Because of many different gaging techniques that yield varying results, screws with threads well outside the Class 3A tolerance limits often pass inspection.

SPS has prepared a new booklet on this subject. It explains clearly what Class 3A threads are and the pros and cons involved in the widely varying gaging techniques in use today. It reviews the gaging of high and low limits of 3A threads, sampling techniques, and even the methods of gaging gages.

All standard UNBRAKO socket screw products fall within specified tolerance limits *no matter what method is used to gage them.* Leading industrial distributors carry complete stocks. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.



Form 2239, "Class 3A Threads: what they are; how to gage them." 16 pages, with many illustrations. Write for free copy today.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION SPS

JENKINTOWN PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 257

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

SLITTING LINES FOR COIL AND SHEET—Yoder Co., Cleveland, Ohio. 76-page fully illustrated catalogue entitled "Multiple Rotary Slitting Lines," providing detailed information on all types and sizes of the company's slitters and allied equipment. Containing two sections, Part I features basic information on design, selection and operation of slitters and slitting lines, including time studies and analysis of operating cycles, discussion of coil handling, scrap disposal methods, and other operating data. Part II deals with specifications, capacity tables, and other data on Yoder slitters, uncoilers, recoilers, coil cars, and scrap choppers. **1**

AIR TOOLS—Thor Power Tool Co., Aurora, Ill. 8-page illustrated catalogue describing the company's air tools. Forty basic tools with thousands of model variations, accessories, and adapters are described. Featured are the Uni-Tork screwdrivers and nutsetters, No. 5V vertical grinders, No. 25G die grinders, No. 3 series straight grinders, and new additions to the No. 4 series. These additions are direct-drive right angle nutsetters, individually engineered multiple units, and grinders. **2**

LIQUID FILTERS—Air-Maze Corporation, Cleveland, Ohio. Bulletin describing the company's all-metal liquid filters and giving complete data for designers and users of equipment requiring full flow filtration of lubricating, hydraulic or fuel oils. Filters are of special metal screen disc construction with precisely controlled openings to assure positive filtration for a selected degree of separation. **3**

PRECISION MACHINE TOOLS—South Bend Lathe Works, South Bend, Ind. 80-page catalogue 5700, describing, illustrating, and pricing the company's entire line of precision machine tools. Equipment shown includes engine lathes, toolroom lathes, turret lathes, vertical-spindle milling machines, bench shapers, drill presses, and pedestal tool grinders. Attachments, tools, chucks, and accessories for all machine tools are also listed. **4**

PRESS-ROOM EQUIPMENT—Special Engineering Service, Inc., Detroit, Mich. 12-page catalogue describing the company's complete line of Ses-Matic press-room equipment. Technical data pertaining to steel coils and various other alloy stock is given. In addition, features and complete specifications are offered on Ses-Matic equipment, including hydraulic punch press feeds, combination cradle and straighteners, loading ramps, power-driven and plain stock straighteners, and air feeds. **5**

STRAIGHT-LINE MACHINE BASES—Ferguson Machine Corporation, St. Louis, Mo. Bulletin 401, describing the company's revised and expanded line of standard Trans-O-Mator straight-line transfer machines for automatic assembly. Advantages of standard machines over special designs are discussed. Typical applications and various design features are illustrated, and dimensions of bases with 6-, 8-, 12-, 16-, and 24-inch strokes are given. **6**

STRAIGHT-SIDE PRESSES—Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. Bulletin No. 13300, covering the company's line of single- and double-crank straight-side presses which have been designed specifically to meet exacting automotive production standards. Press features such as welded frame design, gibbing, air counterbalance, cushions, knockout bars, and flywheel brake are itemized and explained in detail. **7**

GAGES—Cadillac Gage Co., Detroit, Mich. 40-page catalogue illustrating and describing the company's various gage products. Complete specifications on prices and sizes of the line of thread plug gages, thread ring gages, and special gages of all types manufactured by the company are also given. Considerable general information for all metalworking manufacturing is also included. **8**

CONSTANT DISPLACEMENT PUMPS—Oilgear Co., Milwaukee, Wis. Bulletin 46601-B, giving data on the company's continuous pressure, constant displacement, heavy-duty Types HG fluid power pumps. One of the features of this new series is the availability of a purolator type micronic filter to provide 100 per cent filtration of hydraulic fluid prior to its entrance to the high-pressure axial piston end of the pump. **9**

REBUILDING TURRET LATHES—De Silvey Corporation, East Aurora, N. Y. Illustrated brochure describing the company's precision rebuilding and reconditioning operations on Warner & Swasey turret lathes. Step-by-step operations—from the time that the lathe arrives at the company until it is back on the customer's production line—are shown in this brochure. **10**

BENCH AND SMALL PRESSES—E. W. Bliss Co., Canton, Ohio. Bulletin 1-A, describing the company's line of bench presses and small presses. Complete information and engineering data are given on 4- and 10-ton, adjustable bed and horn presses; and 10-ton, floor-mounted, inclinable presses. Also described is the company's rolling key clutch, which is

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standard on all presses described in the bulletin. 11

SCREW CONVEYOR COMPONENTS — Link-Belt Co., Chicago, Ill. Folder 2489, describing the company's ball bearing equipment that is being added to their complete screw conveyor component line. Low starting friction and free-rolling action of all these ball bearing components result in minimum horsepower requirements and negligible maintenance costs. 12

CYLINDRICAL ROLL NECK BEARINGS —SKF Industries, Inc., Philadelphia, Pa. 24-page catalogue entitled "SKF Multi-Row Cylindrical Roll Neck Bearings," containing complete engineering and technical data on the company's multi-row cylindrical roller bearing designed for heavy-duty service in roll neck mountings on all types of hot- and cold-rolling mills. 13

AIRCOMATIC CUTTING — Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City. Catalogue 3170, describing the company's Aircomatic cutting process, a method for straight-line and shape cutting of non-ferrous metals which is particularly applicable for high-speed cutting and shaping of plates and parts to be joined by gas-shielded arc welding. 14

DIE SHARPENING — Oberg Mfg. Co., Tarentum, Pa. Catalogue 356, entitled "Carbide Die Sharpening Procedure," serving as a guide pointing the way to faster, better, and easier carbide die sharpening. This brochure is a supplement to the company's 48-page catalogue entitled, "Precisioneering and Productioneering Oberg Carbide Dies." .15

ELECTRODE DATA BOOK — National Cylinder Gas Co., Chicago, Ill. 24-page electrode data book presenting the following data: AWS-ASTM arc-welding electrode specifications; how to estimate electrode consumption; summary of welding symbols; and factors in selecting electrodes. Other data of interest to users of arc welding is included. 16

PLATE TYPE RHEOSTATS — General Electric Co., Schenectady, N. Y. Bulletin GEA-6474, giving selection information and a wide variety of applications for the company's plate type rheostats. Outstanding features are explained in detail, and six basic modifications of the standard line demonstrating the flexibility of these rheostats are outlined. 17

PUSH-BUTTONS — Cutler-Hammer Inc., Milwaukee, Wis. 26-page booklet entitled "C-H Master Design," featuring the company's entire line of oiltight push-buttons and control units, including indicating lights, selector switches, "Roto-Push" and "Pres-Test" buttons, covers and enclosures, accessories, and dimensional data. 18

PARTS WASHERS—Geor-O-Mation Division, Michigan Tool Co., Detroit, Mich. Bulletin describing the company's production line parts washers. These compact washers are of the needle-spray type with multiple air jets for solvent removal and parts drying. Using a chain drive for parts movement, the washers will handle up to 1000 parts per hour. 19

FLUID POWER EQUIPMENT—Kalamazoo Division of the New York Brake Co., Kalamazoo, Mich. Bulletin 400, describing the company's industrial fluid power equipment. Hydreco gear and dual-vane hydraulic pumps, control valves, and cylinders are fully described; and condensed performance information is included. 20

AUTOMATIC CHUCKING MACHINE—Warner & Swasey Co., Cleveland, Ohio. Catalogue describing the company's 3 AC single-spindle automatic chucking machine which can be set up quickly like a turret lathe, uses standard turret lathe tooling, and changes speeds and feeds automatically under cut. The machine is powered by a 40-H.P. drive motor. 21

SERVO MOTORS—Norden-Ketay Corporation, Stamford, Conn. Bulletin 385, giving complete information on standard and custom servo motors. Data includes electrical and mechanical specifications, application data on direct plate to plate, transistorized servo amplifier, and magnetic servo amplifier applications. ...22

STAINLESS STEELS—Allegheny Ludlum Corporation, Pittsburgh, Pa. 8-page Blue Data Sheet on chromium-nickel-manganese stainless steels, Types 202, 204, and 204L. This data sheet gives detailed information on such items as intergranular corrosion, mechanical properties, analysis, and stress rupture properties.23

CRAWLER TRACTOR SHOVELS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletins MS-1137 and MS-1126, giving information on the company's HD-11G and HD-6G diesel-powered crawler tractor shovels, respectively. Matched attachments designed specifically for each model are described and illustrated. ..24

STEAM COILS — Halstead & Mitchell, Pittsburgh, Pa. Bulletin S-200, describing the company's line of standard and non-freeze steam coils, using "Turbo-Flo" finned surface for extra-high heat transfer. Construction of the coils, including tubing, casings, headers, refrigerant distribution, and valves is outlined. 25

GRINDING AND POLISHING MACHINES —Curtis Machine Division, Carborundum Company, Jamestown, N. Y. Illustrated folder describing the company's Curtis "600" Straight-O-Matic abrasive-belt grinding and polishing machines. Complete specifications for all models are given. 26

OIL-HARDENING TOOL STEEL—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Folder describing the company's Ry-Alloy oil-hardening tool steel, which is supplied in rounds, squares, and flats, for applications ranging from arbors and clutch dogs to thrust washers and trimming dies. 27

PROFILE RECORDER — Micrometrical Mfg. Co., Ann Arbor, Mich. 4-page bulletin describing the company's Proficorder—an instrument for research, experiment, and production, affording an accurate means for showing the true

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

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profile of either machined or finished surfaces. 28

TAPE CONTROL SYSTEM — Electronic Control Systems, Inc., a subsidiary of General Dynamics Corporation, affiliated with Stromberg-Carlson, Los Angeles, Calif. 12-page booklet describing the operating principles of the company's Digimatic tape control system for machine tools—a system for the numerical control of machine tools through magnetic tape. 29

HIGH RESOLVING TRANSDUCERS—Industrial & Scientific Products Division of Curtiss-Wright Corporation, Caldwell, N. J. Leaflet describing the company's Hi-R transducers designed to provide sensitivity and greater resolution in ultrasonic non-destructive testing. 30

VOLTAGE REGULATORS—General Electric Co., Schenectady, N. Y. Bulletins GEA 5752C and GEA 6552, describing the company's step voltage regulators. Both brochures plus one on induction feeder regulators are included in a single package entitled "Your Guide to Profitable Voltage Regulation," GED-3133. 31

STEEL CASTINGS — Dodge Steel Co., Philadelphia, Pa. Specifications folder containing a complete description of twelve Dodge metals for castings. Chemical, physical, and general properties are given for each metal, together with special heat-treatment data. 32

EXPANDING JAW MANDREL—Erickson Tool Co., Cleveland, Ohio. 4-page bulletin describing the company's line of Erickson-Nicholson type expanding jaw mandrels. Type A step-jaw and Type B straight-jaw design mandrels are described and illustrated. 33

TUBULAR SCREEN FILTER—Industrial Filtration Co., Lebanon, Ind. 4-page catalogue describing operations of the company's automatic self-cleaning Filter-Matic tubular screen vacuum filter for low micro-inch finish requirements. . .34

TURRET PUNCH PRESSES—Wiedemann Machine Co., Philadelphia, Pa. Bulletin 201, describing the company's complete line of turret punch presses for use in piercing sheet metal and plate in short to medium production quantities. . . .35

PNEUMATIC TRANSMISSION SYSTEM —Simplex Valve & Meter Co., Lancaster, Pa. Bulletin 750, describing the company's Laminair, a form of pneumatic transmission that provides a sensitive and accurate type of instrumentation. 36

STAGING UNITS — Automation Gages Inc., Rochester, N. Y. Folder introducing the company's Multi-Stage unit, a universal staging unit designed to solve the locating problem for a wide range of projection gaging applications. 37

SYSTEM LOAD AND FREQUENCY CONTROL — Minneapolis-Honeywell Regulator Co., Industrial Division, Philadelphia, Pa. Bulletin B91-1, describing all-electronic load and frequency control systems. 38

TOOL-HOLDERS AND INSERTS—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Catalogue describing the company's Carmet tool-holders and throw-away inserts and giving detailed information on this new line. 39

CONVEYOR CHAINS—Chain Belt Co., Milwaukee, Wis. Bulletin 56-60, describing the company's Rex table top conveyor chains. Both steel and nylon chains are described, and many application illustrations are given. 40

WELDING FLUX CRUSHERS—American Pulverizer Co., St. Louis, Mo. Bulletin 157 entitled "Better Testing and Small Scale Reduction," describing crushers used by manufacturers to reclaim fused welding flux for re-use. 41

STEEL TUBING AND FITTINGS—H-P Products, Inc., Louisville, Ohio. Bulletin No. V-157 describing the company's Vacu-Flo steel tubing and fittings for vacuum systems and conveying lines. .42

CENTRIFUGAL PUMPS—Ampco Metal, Inc., Milwaukee, Wis. Bulletin P-3b and insert P-3c entitled "Ampco Centrifugal Pumps," describing the company's complete line of pumps. 43

SHEET-METAL MACHINES — Niagara Machine & Tool Works, Buffalo, N. Y. 32-page booklet 201, describing the company's line of manually operated machines and tools for light sheet-metal work. 44

PARTS FEEDER—U. S. Engineering Co., New York City. Folder describing the company's Feed-A-Matic parts feeder which performs feeding, orienting, and counting up to 200,000 pieces per hour. 45

MAINTENANCE INSTRUCTIONS FOR FILTERS—Marvel Engineering Co., Chicago, Ill. Illustrated leaflet giving detailed maintenance instructions on the company's filters. 46

CUTTING TOOLS—M. A. Ford Mfg. Co., Inc., Davenport, Iowa. Catalogue 601, describing the company's rotary cutters, countersinks, carbide end-mills, and special cutting tools. 47

JIG BORER—Opto-Metric Tools, Inc., New York City. 8-page catalogue de-

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scribing the Leitz 6- by 6-inch optical jig borer with setting in decimals or 0.05 inch. 48

TAP DRIVERS—Scully-Jones & Co., Chicago, Ill. Bulletin No. 20-50, describing the company's three types of Safe-Torque tap drivers designed to increase tap life and production. 49

PNEUMATIC AND HAND CHISELS—Bedford Tool & Forge Co., Bedford, Ohio. Catalogue standardizing pneumatic and hand chisels by point style, body size, and shank type. 50

HACKSAW BLADES—Heller Tool Co., Newcomerstown, Ohio. 8-page catalogue describing the company's line of job-tempered, hand and power hacksaw blades. 51

DIE-CASTING MACHINES — Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin describing the company's Models 50, 200, 400-N, and 600 Cleveland die-casting machines. 52

BUSHED ROLLER CHAIN — Link-Belt Co., Chicago, Ill. Catalogue 2454, containing a complete presentation of the features of the company's LXS bushed roller chain. 53

AUTOMATION UNITS—Jones & Lamson Machine Co., Springfield, Vt. Illustrated folder giving information on the company's various types of automation units. 54

MOTOR SELECTION GUIDE — Century Electric Co., St. Louis, Mo. 12-page catalogue facilitating selection of electric motors for all popular applications. ..55

PRECISION CAMS—Trofimov Industries, Precision Cam Division, Mentor, Ohio. Leaflet describing a new method of making precision cams. 56

WELDED STEEL TUBING—Armco Steel Corporation, Middletown, Ohio. Catalogue describing the company's welded steel tubing formed from Zincgrip, aluminized, hot-rolled, and cold-rolled steel. Pressure-tested tubing and fabricated parts are also included. 57

BARREL PLATING—Udylite Corporation, Detroit, Mich. Technical bulletin ZP-ZB-57, describing in detail the company's zinc-plating process. 58

LEAD COMPARATOR—Jerpbak-Bayless Co., Solon, Ohio. Leaflet describing the company's bench Model SK-1003 lead comparator. 59

LIMIT SWITCHES—R. B. Denison Mfg. Co., Cleveland, Ohio. Bulletin 956, describing the company's heavy-duty limit switches. 60

BALL BUSHINGS—Thomson Industries, Inc., Manhasset, N. Y. Leaflet describing the company's ball bearing for linear motions. 61

GEARS—Horsburgh & Scott Co., Cleveland, Ohio. Catalogue No. 57, containing complete information on gear materials and heat-treatment, gear-cutting capacities for all of the company's gear types, tooth forms, comparisons for milled-form and generated spur gears, and providing rules for ordering. 62

SEAMLESS STAINLESS TUBING—Babcock & Wilcox Co., Tubular Products Division, Beaver Falls, Pa. Technical data sheet contained in ASL No. 285 and ASL No. 286 offering data on the company's Croloy 27-4-1 (Type 329) and Croloy 25-12 (Type 309S) in tubular form, respectively. 63

HYDRAULIC VALVES—R. D. Wood Co., Philadelphia, Pa. Catalogue entitled "High Pressure Hydraulic Valves," listing and describing 24 different styles of the company's valves for hydraulic systems. These valves range from 1500 to 20,000 pounds per square inch in working pressure. 64

PIPE CRIMPER—Niagara Machine & Tool Works, Buffalo, N. Y. Illustrated supplement to Bulletin 78-B presenting the company's latest addition to the line of hand tools for sheet-metal work—the Model 500 compound leverage pipe crimper. 65

WIRE ROPE—Macwhyte Co., Kenosha, Wis. Bulletin 5702 entitled "The Correct Wire Rope for Contractors' Equipment," listing proper wire rope specifications for all types of construction equipment. ..66

MOTOR SCRAPER—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Catalogue describing design, engineering, construction, and operating features of the company's TS-360, 20-cubic-yard motor scraper. 67

CENTERLESS LAPPING MACHINE — Cincinnati Milling Machine Co., Cincinnati, Ohio. Catalogue G-683 describing the company's Filmatic centerless lapping machine. 68

WET HONE EQUIPMENT—Clementina Ltd., San Francisco, Calif. Folder describing and illustrating the company's wet hone machines. 69

CHUCKS—Buck Tool Co., Kalamazoo, Mich. 24-page catalogue describing the company's various chucks. 70

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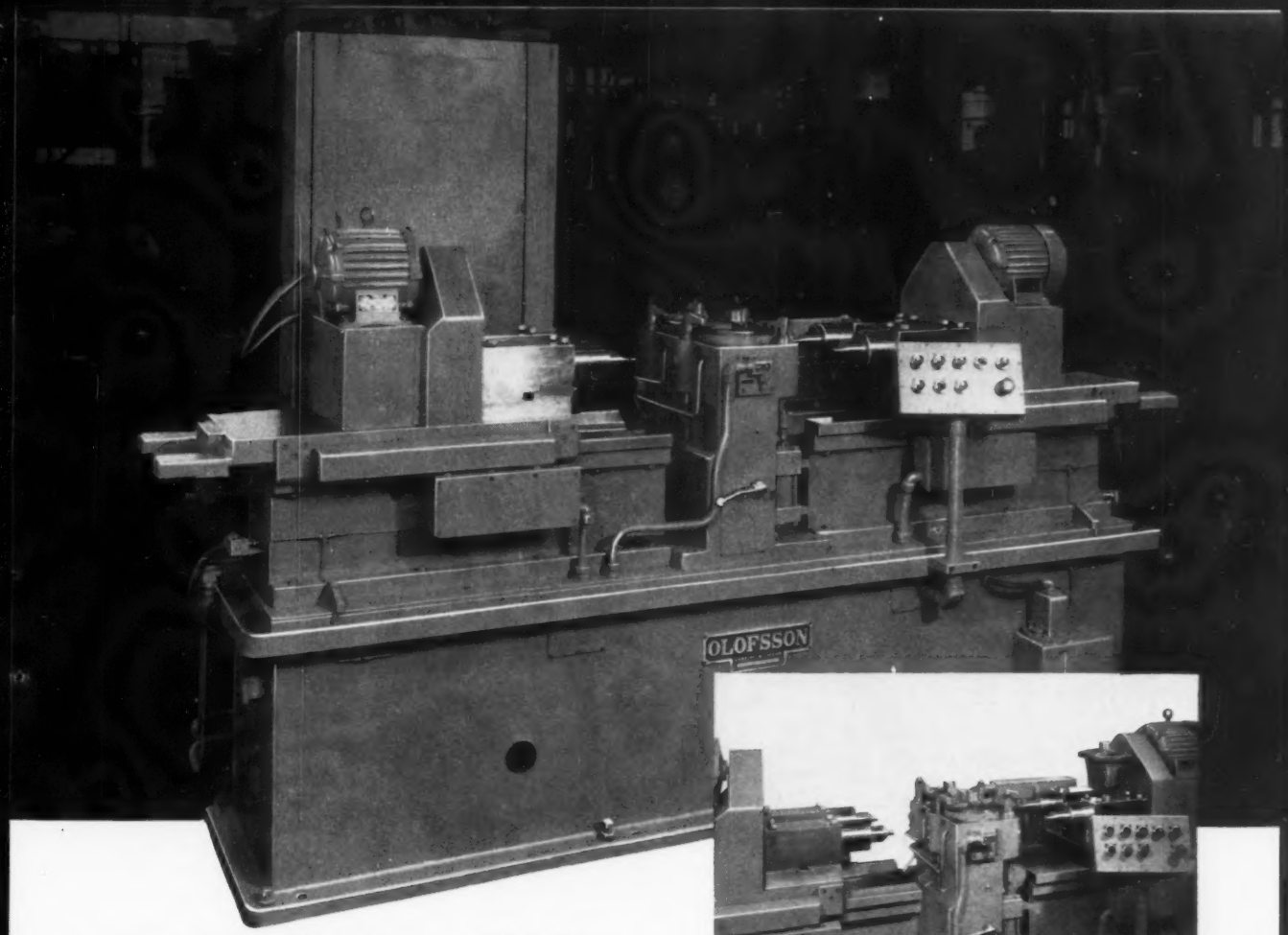

Is any part of your production COSTING TOO MUCH?

Today's competitive market demands constantly increasing production per man hour. Any machine tool which can't deliver that kind of production is too costly to operate. That's why an automotive manufacturer recently consulted with Olofsson engineers to increase production and lower unit costs on a boring operation. The result...

TYPE OF MACHINE—Olofsson Two Station Double End Precision Boring Machine arranged with Way Units.

WORK PERFORMED—Finish bore two holes, *in line,* simultaneously in cast iron differential cases.

RATE OF PRODUCTION—250 cases per hour.

MACHINE OPERATION—The operator loads the part into the nest and presses the clamp and start cycle button. Both units bore "in" simultaneously and rapid return to unload position. Hydraulically operated finger clamps release the part automatically when both units are in clear position. A manually operated elevator device is used to help insert and unload part from nest with ease.

Hand cycle provides additional retraction of spindles for setting or removal of cutting tools, also independent control of either unit.

Perhaps you have a tough production problem which can be solved efficiently and economically with Olofsson Special Machinery. You'll find it "pays to specialize with Olofsson".

Olofsson Two Station Precision Boring Machine arranged with Way Units. Conforms to J.I.C. electrical and hydraulic standards.

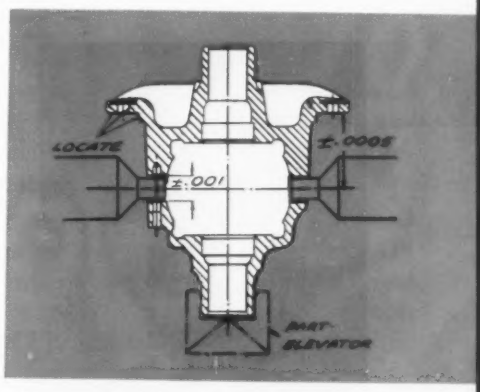

Diagram of differential case clamped into position for simultaneous, double-end precision boring operation.

Put the Olofsson Engineering Department to work for you. Write today. Or phone us at IVanhoe 4-5381, Lansing, Michigan.

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2729 Lyons Avenue • Lansing, Michigan

Manufacturers of Special and Automation Machinery and Precision Boring Machines

JAMES B. WILKIE, manager of the Gage Division of Pratt & Whitney Co., Inc., West Hartford, Conn., has been appointed to the executive board of the Dimensional Standards and Metrology Division of the American Ordnance Association, Washington, D. C.

VAN NORMAN MACHINE CO., Springfield, Mass., announces the election of two directors: SELBY F. GREER and FRANCIS P. HEALY. Mr. Greer is president of Van Norman Automotive Equipment Co., and Mr. Healy is vice-president of the same company.

DR. ROLAND E. KREIBICH has been appointed product engineer in the Phenolic Products Section of General Electric Co.'s Chemical Materials Department, Pittsfield, Mass.

BROWN & SHARPE MFG. CO., Providence, R. I., announces the appointment of Mid Island Supply Co., 29-08 39th Ave., Long Island City 1, N. Y., as an authorized distributor of repair and replacement parts for the company's automatic and hand screw machines, grinding machines, and milling machines.

TAFT-PEIRCE MFG. CO., Woonsocket, R. I., announces establishment of a new Instrument Gage Division. This division will be under the direction of FRANKLIN MEYER, JR., as manager.

New York and New Jersey

CARBORUNDUM COMPANY, Niagara Falls, N. Y., announces the election of five vice-presidents: NILES C. BARTHOLOMEW, formerly vice-president of the subsidiary Carborundum Metals Co., Inc., was elevated to vice-president of the parent company and will continue as general manager of Carborundum Metals Co., now a division of the company. GENE DEMAMBRO, since 1946 president of the Curtis Machine Corporation, continued as that company's president when it was made a subsidiary of Carborundum in 1955. Curtis Machine Corporation is now designated a division of the Carborundum Company and Mr. DeMambro has been promoted to vice-president of the Carborundum Company in charge of the Division as its general manager. I. WENDELL HAMM was named vice-president of the company and will continue to direct the activities of the Manufacturing Division. JOSEPH S. IMIRIE has been elected vice-president and will continue as general manager of the Electro Minerals Division. LESLIE E. SIMON, who came to Carborundum in 1956, was named vice-president and will continue as director of research development.

AIR REDUCTION SALES CO., New York City, has named three regional vice-presidents to administer field activities pertaining to production, distribution, and sales: A. C. BROWN, JR., general sales manager, was named vice-president—eastern region with offices in New York City; D. D. SPOOR, equipment sales manager, New York, has been appointed vice-president—midwestern region and will be located in Chicago, Ill.; and J. J. LINCOLN, JR., vice-president, New York, will become vice-president—southern region with headquarters in Houston, Tex.

Adolphe J. De Matteo, general manager, Watson-Stillman Press Division

ADOLPHE J. DE MATTEO has been appointed general manager of the Farrel-Birmingham Co., Inc., Watson-Stillman Press Division, Roselle, N. J. Mr. De Matteo joined the company in 1944, was appointed assistant chief engineer in 1946, and chief engineer in 1951. As general manager, Mr. De Matteo will direct engineering and sales activities.

NIAGARA MACHINE & TOOL WORKS, Buffalo, N. Y., announce that their Cleveland, Ohio, district office has moved to a new location at 6333 York Road.

OAKITE PRODUCTS, INC., New York City, announces two changes in its field service organization. E.

(*Continued on page 266*)

(Left to right) A. C. Brown, Jr., vice-president, eastern region; D. D. Spoor, vice-president, midwestern region; and J. J. Lincoln, Jr., vice-president, southern region, of Air Reduction Sales Co.

An economical hydraulic fluid that actually snuffs out fire!

WHEREVER a fire hazard exists near a hydraulic system, you can greatly reduce this hazard without excessive costs by specifying Shell Irus Fluid 902. This new hydraulic fluid is a "snuffer" type fluid with water dispersed in oil.

Because Irus* Fluid 902 is economical, many plant operators have found they save thousands of dollars yearly when the changeover is made. And they obtain performance which is unsurpassed by much higher priced fire-resistant fluids.

For complete information on Shell Irus Fluid 902 write to Shell Oil Company, 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

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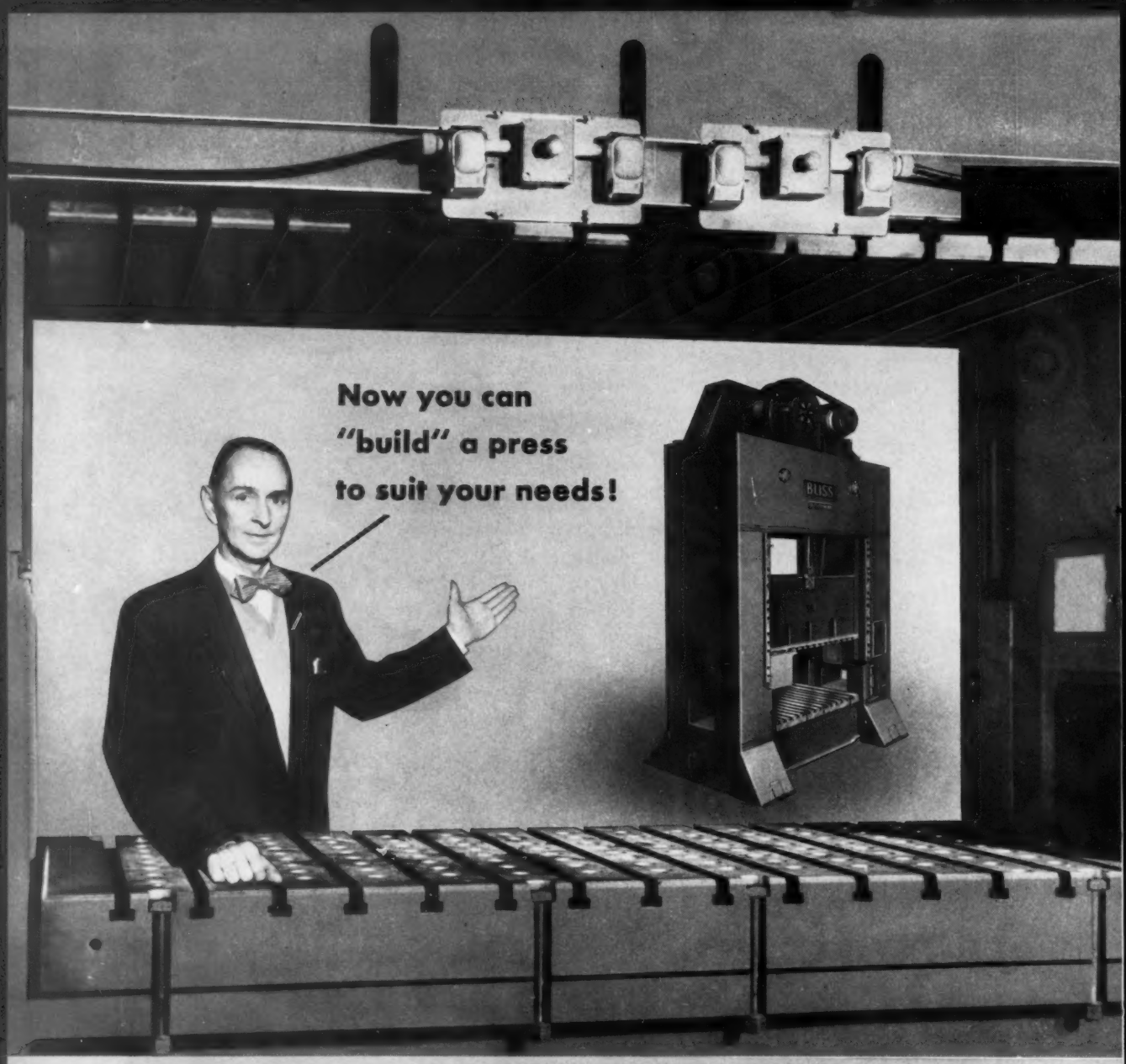


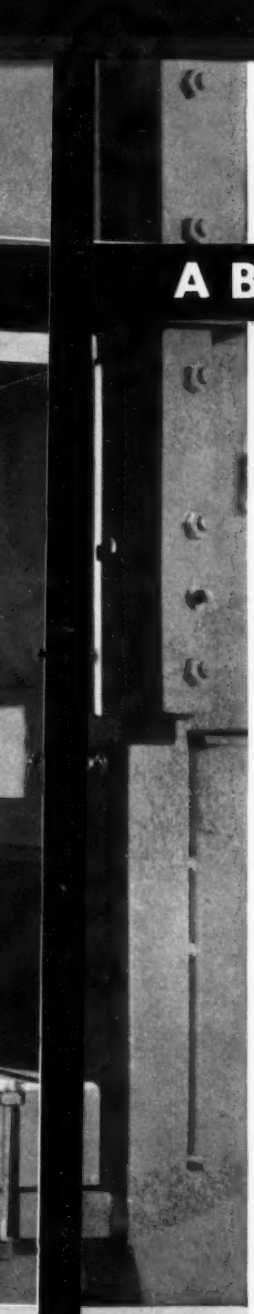
Why buy a press designed for someone else?

To these basic design advantages of the new Bliss SE-2 press . . .

- Enclosed design, all-welded construction, four-piece frame with tie rods drilled for electrical shrinking
- Recirculating oil system for gears, shafts, bearings, slide adjustment and *flywheel roller bearings*
- Bronze liners on the slideways running against lubrized cast iron gibs
- Motorized slide adjustment
- Counterbalance tanks
- JIC sizes
- Anti-friction bearings on *intermediate shaft* as well as on flywheel

. . . you can add any or all of these optional features

- Provision for automation controls and feeds
- Inbuilding
- Recirculating oil to the slide gibs
- Recirculating oil to the cushion gibs
- Automatic lubrication to counterbalances and cushion internals
- Air and electrical maintenance outlets
- Die lights
- Air control manifolds
- Special controls



A Bliss Chief Engineer tells...

How press buyers can "tailor" Bliss' new eccentric-gear design to fit their own needs!

"It's almost impossible to design a large press to please everyone. Yet that's exactly what we have tried to do with our new one point, two point and four point presses," says Chief Engineer Bill Staecker, of Bliss' Canton Plant.

"Here is how we approached the problem. Our field sales engineers worked for months with customers' operating executives and our press designers. On the one hand were the widely varying requirements of the big automated mass-production stamping plants; on the other, the needs of the job shops who use their presses for short runs. It was rare to find two sets of requirements alike.

"Flexible" design proves answer

"It was apparent that what was needed was a *flexible* basic design—a press that could have features added or subtracted to meet any user's needs without making him pay for features he didn't want. You can see how we have solved the problem by looking at the table of specifications at the left.

New drive cuts maintenance

"But...above and beyond the benefits of this basic design, these new Bliss presses have a 'unitized' drive mechanism based on a special *demountable* flywheel and outboard clutch. To get an idea of what this unitized design does for maintenance, consider these facts:

"Except for the main gears, nothing is built into the crown. The entire drive can be removed as a unit. Belts can be replaced without removing anything but the brake pins. And the entire clutch can be taken off simply by removing the brake bracket.

"You can see what this ease of disassembly and reassembly means when you compare it to maintenance steps on your present enclosed presses."

To sum up, when you buy one of these new presses, you pay for just what you need *and no more*. And you're buying the only fully-enclosed straight side press that is truly easy to maintain.

The new Bliss eccentric-gear presses are available in a full line of tonnages in both double and single geared models. For full details, write us today.

BLISS
SINCE 1857

100 years of making metals work for mankind

E. W. BLISS COMPANY, CANTON, OHIO
PRESSES, ROLLING MILLS, ROLLS, SPECIAL MACHINERY

U. S. Plants: Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pa.; Branch Offices throughout the country.

LACY has been transferred to Houston, Tex., and JOHN C. RUTTLE will serve the metal industries in western Detroit.

SENECA FALLS MACHINE CO., Seneca Falls, N. Y., announces the appointment of ZIMMERMAN & GAUMOND, INC., Park Ridge, Ill., as representatives in Illinois, Iowa, southern Wisconsin, and South Bend, Ind.

KURT J. UCKO, sales manager of the Machine Tool Division of Kurt Orban Co., Inc., Jersey City, N. J., has been elected a vice-president.

Kurt J. Ucko, vice-president, Machine Tool Division of Kurt Orban Co., Inc.

Mr. Ucko joined the company in 1952 and was appointed sales manager of the combined Gear and Machine Tool Division in 1956.

Ohio

CLEVELAND AUTOMATIC MACHINE CO., Cincinnati, Ohio, has announced its merger with the J. H. DAY CO., INC., also of Cincinnati. The name of the continuing corporation is the Cleveland Automatic Machine Co. Day operations will be continued as J. H. Day Co. Division of Cleveland Automatic Machine Co. The merger of these companies is part of the expansion and diversification program of the R. K. LeBlond Machine Tool Co., which owns the Cleveland Automatic Machine Co.

CLARK CONTROLLER CO., Cleveland, Ohio, has named W. R. HECKMAN and J. H. HEUSLEIN to newly created positions in its production organization as assistants to R. L. PUETTE, vice-president—operations division.

Raymond E. Channock, vice-president and treasurer, National Acme Co.

RAYMOND E. CHANNOCK has been elected vice-president and treasurer of the National Acme Co., Cleveland, Ohio. Mr. Channock joined the company in 1944 as assistant treasurer. He became comptroller in 1945 and served in that capacity until his recent election.

BALDWIN-LIMA-HAMILTON CORPORATION has completed transfer of the manufacturing and sales operation of its hydraulic and compacting press department from the Eddystone Division, near Philadelphia, to the Hamilton Division, Hamilton, Ohio. The operations have been integrated with those of the mechanical press department.

J. HERBERT MYERS has joined the executive staff of the Cincinnati Shaper Co., Cincinnati, Ohio, as director of overseas operations. Mr. Myers has thirty-eight years experience in the machine tool industry.

J. Herbert Myers, director overseas operations, Cincinnati Shaper Co.

Pennsylvania and Maryland

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces the appointment of GEORGE W. STAMM as general manager of sales. At the same time, the following appointments were announced: EDWARD A. FLEMING was made manager of the Philadelphia sales branch. Mr. Fleming replaces CHARLES H. STOECKLE, manager since 1942, who retired. DANIEL A. PORCO has been appointed manager—development, and C. H. LIBBY has been appointed controller, succeeding Mr. Porco. FELIX KREMP was named assistant product manager—high-speed tool steel sales, and E. E. LULL has become assistant product manager, also of high-speed tool sales. J. H. WHELAN was made manager of warehousing, and PAUL P. HUBERT, assistant manager in charge of warehouse inventory.

UNITED STATES STEEL CORPORATION, Pittsburgh, Pa., announced the appointment of JOHN H. MORAVA as president of the company's Steel Supply Division. Mr. Morava succeeded LESLIE B. WORTHINGTON, who was recently made president of the Columbia-Geneva Steel Division in San Francisco.

RUSSELL F. CLARK CO., Pittsburgh, Pa., has been appointed sales representative in West Virginia and western Pennsylvania areas for the Servo Corporation of America, New Hyde Park, N. Y.

SCHROEDER BROTHERS CORPORATION, Pittsburgh, Pa., representative dealer for Rivett Lathe & Grinder, Inc., Boston, Mass., has moved to a new location at Box 72 Nichol Ave., McKees Rocks, Pa.

SAMUEL N. PRITCHARD has been named general sales manager for Henry Disston Division, H. K. Porter Co., Inc., Philadelphia, Pa.

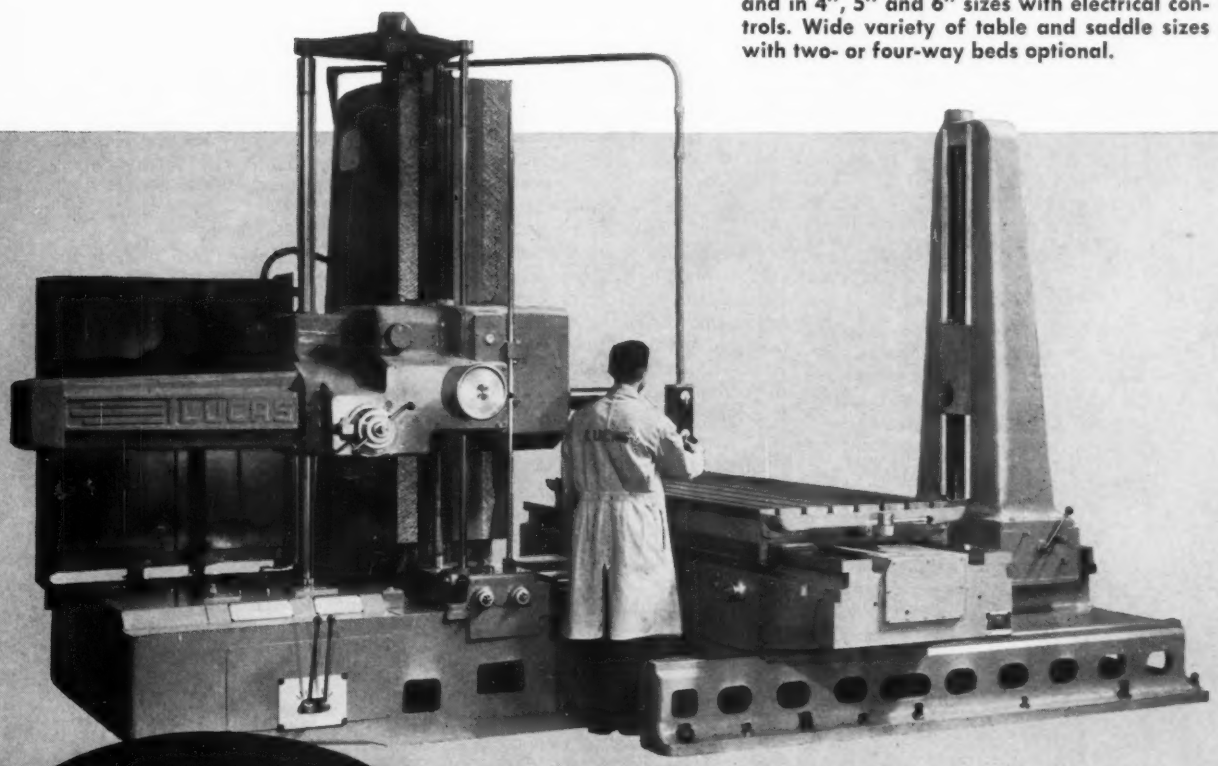
ROBERT G. HALL has been appointed blast descaling representative for the Pangborn Corporation, Hagerstown, Md. In his new position, Mr. Hall will work on all industrial descaling applications, as well as special steel mill equipment for mill roll blasting, ingot mold cleaning, and other processes.

(This section continued on page 268)

there's always work for a Lucas

Extreme accuracy, feather-touch pendant control, automatic power positioning for repetitive work make a Lucas the most useful machine in any shop. There's a model and size for *your* horizontal boring, drilling and milling operations. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

A complete range of models, built in 3", 4" and 5" spindle sizes with mechanical controls and in 4", 5" and 6" sizes with electrical controls. Wide variety of table and saddle sizes with two- or four-way beds optional.



LUCAS OF CLEVELAND

A DIVISION OF THE NEW BRITAIN MACHINE COMPANY

Other New Britain Machine Tool Divisions

New Britain-Gridley Machine Division
New Britain, Connecticut

Hoern & Dilts Division
Saginaw, Michigan

ALLIED CARBIDE PRODUCTS INC., Hatboro, Pa., has been named an authorized Carboloy cemented carbide die products agent by General Electric's Metallurgical Products Department, Detroit, Mich.

THOMAS M. REES, formerly president of the Rees Machinery Co., Inc., Pittsburgh, Pa., is now affiliated with the STANLEY BERG MACHINERY Co.

REVONAH SPINNING MILLS, Hanover, Pa., announce acquisition of the entire stock of Mummert-Dixon Co., also of Hanover, manufacturers of wire cloth machinery, grinders, facing and boring heads, and special machinery.

SAMUEL C. CLARKE has been appointed manager of sales for the Chambersburg Engineering Co., Chambersburg, Pa.

New Books and Publications

THE DIECASTING PROCESS. By H. K. Barton. 224 pages, 6 by 9 inches; 45 illustrations; 50 tables. Published by the Macmillan Co., 60 Fifth Ave., New York 11, N. Y. Price, $5.

This book provides comprehensive, detailed, and up-to-date information for all those engaged in making, buying, or using die-castings. It will be of practical value to all drawing offices, for it shows clearly—with the help of many illustrations—what types can and cannot be incorporated in a die-casting component, and also deals exhaustively with purchasing specifications.

MACHINE TOOLS FOR METAL CUTTING. By W. H. Armstrong. 347 pages, 6 x 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $5.

This book presents in a simple, readily understandable manner machine tools and the work they are used for. Subject matter deals with materials, tools, and processes employed in the machine shop only. It does not deal with other areas of manufacturing.

TOOL DESIGN. By Cyril Donaldson and George H. LeCain. Second edition. 550 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $6.75.

The text covers a course in tool design, written especially for class study with questions, problems, drawing assignments, and references. Each topic is developed in logical order and is supplemented with drawings and worked-out examples.

General methods of tool design, enabling the reader to develop ideas into practical specifications for modern manufacturing methods, form the basis for this work.

ELEMENTS OF ENGINEERING THERMODYNAMICS. By Rolf H. Sabersky. 307 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $7.50.

This book outlines the principles of thermodynamics. Basic laws are stated, and their experimental foundations are discussed. In deriving consequences from the basic laws, the assumptions are emphasized that care has been exercised to distinguish clearly between the basic laws and derived relationships which are valid in more restricted cases only.

In illustrating the application of thermodynamics to various engineering problems, the industries which at present employ the largest number of engineers were particularly considered. The problems in the text form an integral part of the presentation, and their solution and discussion are essential for the development of the subject. Several more difficult problems are worked out as examples.

RESISTANCE WELDING MANUAL. Volume I. Edited by E. J. Del Vecchio, 350 pages, 6 by 9 inches. Third edition. Published by the Resistance Welder Manufacturers' Association, 1900 Arch St., Philadelphia 3, Pa. Price $3.

This book includes two sections. The first is an introduction and covers the fundamentals of resistance welding. The principles involved in the various resistance welding processes are included, and there are separate chapters on spot-welding, projection welding, seam welding, and flash and upset butt-welding.

Section II is devoted to the technique of applying the processes mentioned to various materials. AWS recommended practices and other recommended schedules are also a part of this section.

Coming Events

MARCH 11-15—NUCLEAR CONGRESS to be held at the Convention Hall, Philadelphia, Pa., under the coordination of the Engineers Joint Council. Peacetime uses of atomic energy will be the topic of this Congress. Further information can be had from the Engineers Joint Council, 29 W. 39th St., New York 18, N. Y.

MARCH 11-15—International Atomic Exposition in conjunction with the 1957 Nuclear Congress to be held in the Philadelphia Convention Hall. Foreign firms and governments wishing to participate may get complete information from the nearest United States consulate or legation, or direct from the Exposition Officers, International Atomic Exposition, Inc., 304 Architects Building, Philadelphia, Pa.

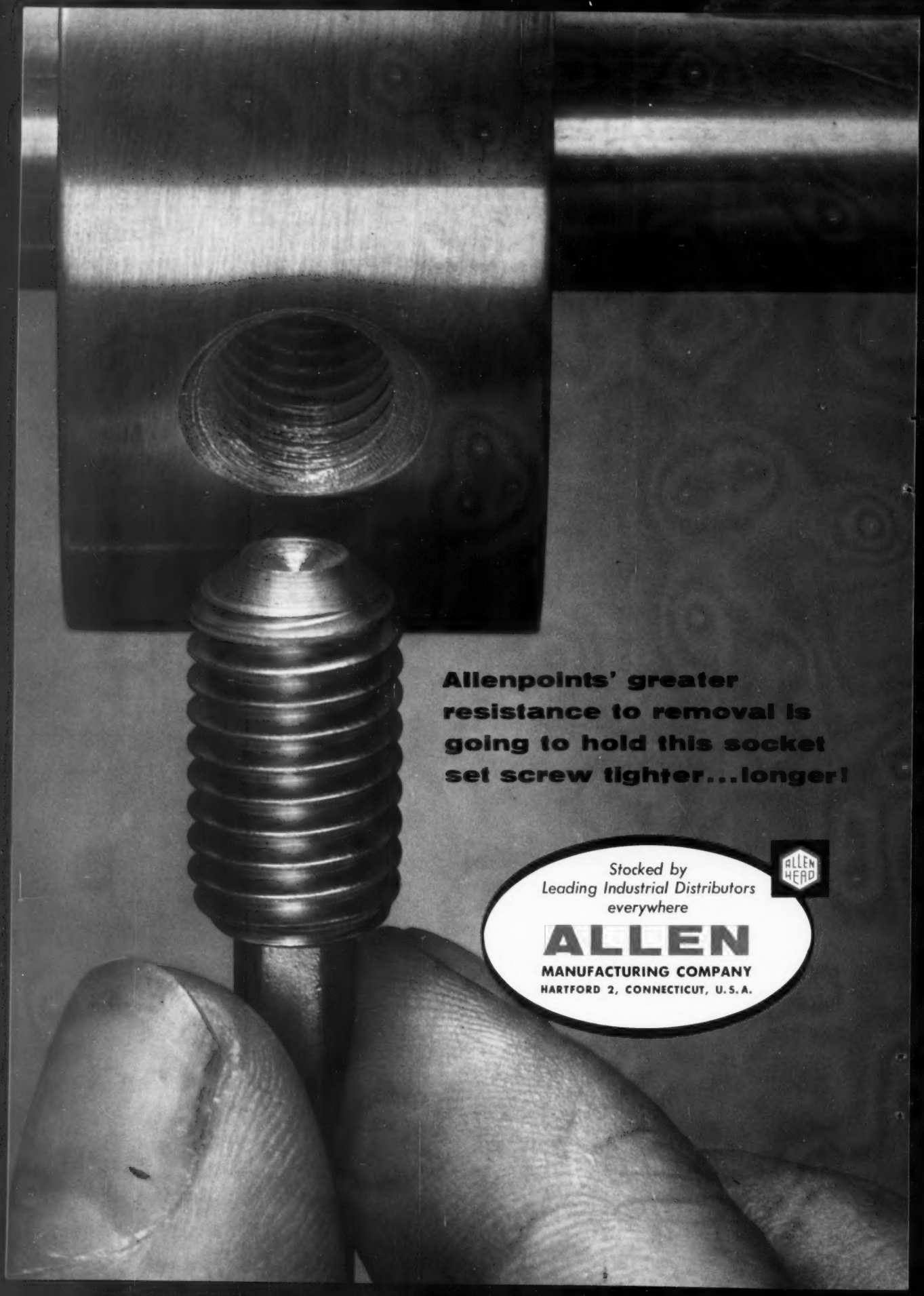
MARCH 25-27—Silver Anniversary, Technical Meeting, and Convention of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Shamrock Hilton Hotel, Houston, Tex., will include symposiums on ceramic and plastic tooling, technical papers, and panels. Program Director L. S. Fletcher, 10700 Puritan Ave., Detroit 38, Mich.

MARCH 25-29—Tenth Western Metal Exposition and Congress, sponsored by the AMERICAN SOCIETY FOR METALS and other technical groups to be held at the Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif. Managing Director W. H. Eisenman, 7301 Euclid Ave., Cleveland, Ohio.

APRIL 9-11—Fifth Welding Show and Industrial Exposition sponsored by the AMERICAN WELDING SOCIETY to be held at Convention Hall, Philadelphia, Pa. Advance registration tickets and hotel information may be obtained from Robert T. Kenworthy, exposition management, 12 E. 41st St., New York 17, N. Y.

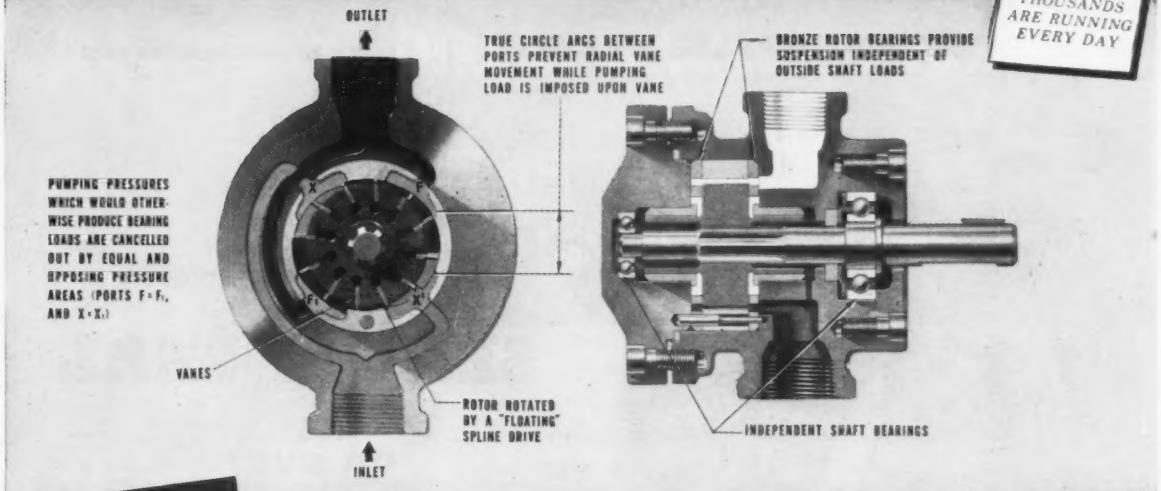
MAY 1-3—ELECTRONIC COMPONENTS SYMPOSIUM co-sponsored by four leading electronic organizations, to be held at the Morrison Hotel, Chicago, Ill. This meeting also has the active participation of agencies of the Department of Defense and the National Bureau of Standards. Information can be obtained from J. S. Powers, Electronic Components Symposium, 84 E. Randolph St., Chicago 1, Ill.

For tool
and work holding
it's
Jacobs
CHUCKS
Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.
The Jacobs Manufacturing Company • West Hartford, Connecticut

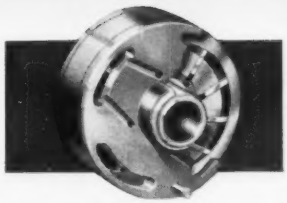

Allenpoints' greater resistance to removal is going to hold this socket set screw tighter...longer!
Stocked by Leading Industrial Distributors everywhere
ALLEN
MANUFACTURING COMPANY
HARTFORD 2, CONNECTICUT, U.S.A.
ALLEN HEAD

Question: Why are VICKERS Balanced Vane Type Pumps the most widely used oil hydraulic power pumps?

HUNDREDS OF THOUSANDS ARE RUNNING EVERY DAY


OUTLET
TRUE CIRCLE ARCS BETWEEN PORTS PREVENT RADIAL VANE MOVEMENT WHILE PUMPING LOAD IS IMPOSED UPON VANE
BRONZE ROTOR BEARINGS PROVIDE SUSPENSION INDEPENDENT OF OUTSIDE SHAFT LOADS
PUMPING PRESSURES WHICH WOULD OTHERWISE PRODUCE BEARING LOADS ARE CANCELLED OUT BY EQUAL AND OPPOSING PRESSURE AREAS (PORTS F=F1 AND X=X1)
VANES
ROTOR ROTATED BY A "FLOATING" SPLINE DRIVE
INDEPENDENT SHAFT BEARINGS
INLET

Answer: Because of their SUPERIOR PERFORMANCE and MANY OTHER BENEFITS for the user.



For more than two decades, the Vickers Balanced Vane Type has held the leading position among hydraulic power pumps . . . growing steadily in popularity. The various models (see below) are *the most widely used of all pumps in oil hydraulic service.*

Above is the pumping cartridge which is one of this pump's distinctive features. The many advantages listed at the right merit the thoughtful attention of anyone concerned with the selection and use of oil hydraulic pumps.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

ADMINISTRATIVE and ENGINEERING CENTER

Department 1403 • Detroit 32, Michigan

Application Engineering Offices: • ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • GRAND RAPIDS HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

COMPLETE HYDRAULIC BALANCE—Each inlet and outlet port is balanced by another equal in size and radially opposite . . . pressure-induced bearing loads are thus eliminated. Pressure-balanced porting plates maintain ideal running clearances.

FLOATING SPLINE DRIVE—Rotor is driven by a "floating" spline. Rotor and shaft have separate bearings . . . avoiding strain from drive misalignment.

TRUE-CIRCLE CAM ARCS between ports prevent radial vane movement while pumping load is imposed upon vanes. Wear between vanes and rotor is thus practically eliminated.

ABILITY TO TOLERATE DIRT—Clean oil is of great importance in a hydraulic circuit; but, in spite of care, dirt sometimes gets in. The Vickers Vane Type Pump will pass a reasonable amount of dirt without trouble and without grinding it up.

REPLACEABLE CARTRIDGE—Cartridge (illustrated above left) contains all pumping parts that move . . . none contact the housing. Working parts can be removed and inspected without disconnecting piping or drive coupling. Replacement cartridge kits are available and pumps need not be sent to the factory for repairs. Pump capacity can be changed by simply changing cartridge in the field.

HIGHER EFFICIENCY—Tests prove exceptionally high volumetric and overall efficiency . . . not only when pump is new but also after long service.

AUTOMATIC WEAR COMPENSATION—Vanes are held in contact with the cam ring by centrifugal force and hydraulic pressure. If wear occurs, vanes revolve in a slightly larger orbit without appreciable change in performance.

MINIMUM MAINTENANCE—Hydraulic balance . . . floating spline drive . . . independent bearings . . . automatic wear compensation eliminate the most important causes for maintenance and repair.

TEMPERATURE ADAPTABILITY—Correct running clearances are automatically maintained which compensate for wide variation in oil viscosity resulting from temperature variation.

LONGER LIFE—The numerous features mentioned above that keep down maintenance also contribute to longer life. Then, a new cartridge completely rejuvenates the pump.

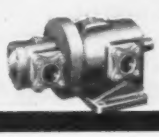
CONSTRUCTION SIMPLICITY is evident from the illustrations above. This simplicity is another reason for the superiority of Vickers Vane Pumps. For further information, ask for Bulletin 5002A.

7182

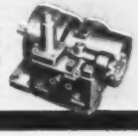
ALL MODELS HAVE THE VICKERS ADVANTAGES MENTIONED ABOVE

Single Stage. Pressures to 1,000 psi. Capacities to 55 gpm.

Two Stage. Pressures to 2,000 psi. Capacities to 55 gpm.



Double Pump—Two pumps for separate circuits driven by common shaft.

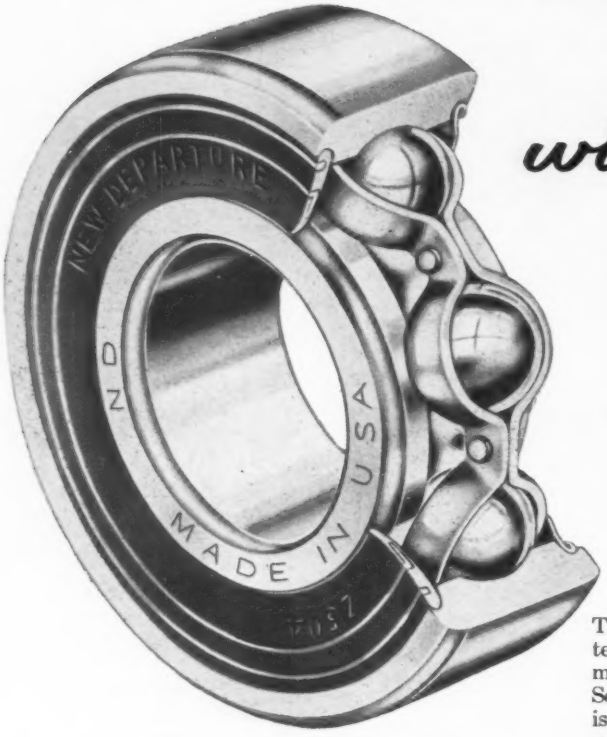


Two-Pressure Pump automatically delivers larger volume at low pressure and smaller volume at high pressure.

FACTS

about

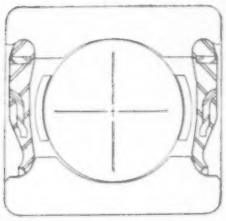
NEW DEPARTURE BALL BEARINGS



with

SENTRI-SEAL

on guard against dirt and wear!



The diagram shows in section the New Departure Sentri-Seal. Lip-contacting surfaces are form-ground simultaneously with the ball race, giving an extremely high degree of concentricity between sealing surfaces and the raceway.

The unique design of the Sentri-Seal gives optimum protection against dirt, and includes a number of other major advantages.

Sentri-Seals can be removed, easily replaced. As the seal is of synthetic rubber in which two metal rings are embedded, a constant-rate spring is created between the rings. Inherent flexibility prevents distortion of the bearing outer ring due to seal insertion, permitting the use of bearings to the higher accuracy specifications. The spring action maintains an efficient sealing contact with the bearing ring to bar dirt and retain lubricant. Sentri-Seals are relatively inert to oils and greases and operate satisfactorily through a temperature range of −40°F. to 225°F. Specifications available for still higher temperatures. In applications where relubrication is desired, it is easily accomplished by the injection method.

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV

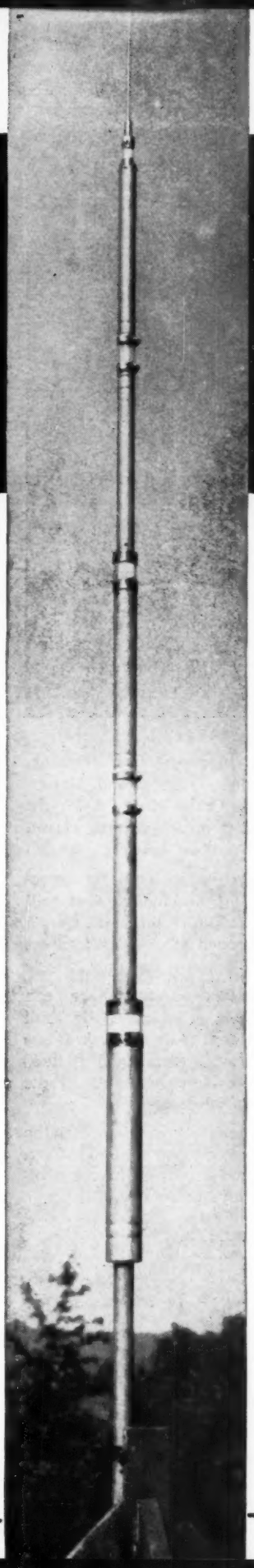
Sentri-Seal is available for a range of sizes in single-row, standard-width bearings and also in two types of New Departure adapter bearings. Sizes, dimensions and capacities are listed in the latest New Departure catalog.

Write for full details on Sentri-Seal

BALL BEARINGS MAKE GOOD PRODUCTS BETTER

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

For more information fill in page number on Inquiry Card, on page 257



Mast of SHELBY SEAMLESS TUBING

(USS STAINLESS STEEL)

provides high strength and corrosion resistance for coaxial antenna

The Type 3006 Coaxial Colinear Antenna*, consisting of three half-wave vertical dipoles arranged colinearly and operating on a frequency range of 152-176 MC, is especially suitable for patrol car broadcasting. The three vertically arranged dipoles exhibit a gain of 5 to 6 db over a standard single dipole, and produce a low angle of radiation with equal radiation in all directions.

This 13½-foot, 40-pound antenna is supported by a mast made of Shelby Seamless Tubing (USS Stainless Steel) running through its center. In addition to possessing the tensile strength to withstand 100-mile-per-hour winds, this stainless supporting mast has high corrosion resistance—will not flake from oxidation and cause short circuits.

In such critical applications where superior strength, uniformity, dimensional accuracy and corrosion resistance are needed, Shelby Seamless Tubing of USS Stainless Steel is consistently chosen to meet the requirements. Shelby Seamless Tubing, available in a wide range of diameters, wall thicknesses, various shapes and steel analyses, is produced to exacting standards by the world's largest manufacturer of tubular steel products. If you wish, our engineers will make a study of your requirements, and will help you apply Shelby Seamless Steel Tubing to your specifications.

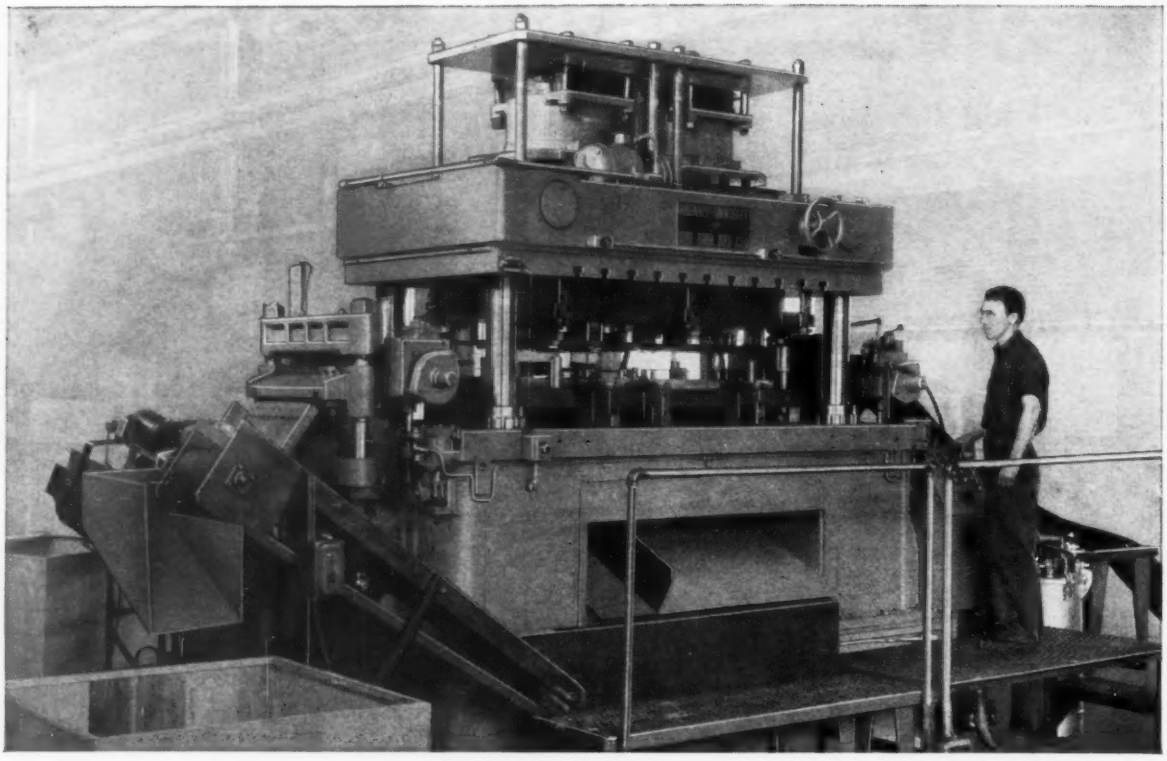
*Name of manufacturer on request.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL



Henry & Wright Double Crank

"definitely improved our competitive position"

TO KEEP PACE with trends in progressive stamping, Grand Haven Stamped Products Co., Grand Haven, Mich., bought a 100-ton Single Crank Henry & Wright in 1954. Its performance was so impressive, Grand Haven purchased a 200-ton Double Crank in 1956.

ON VERY FIRST JOB the new machine equalled expectations. The part involved — an automotive vent grill — is produced two at a time on a multi-station die from a 15⅝" strip of 22-gauge, cold-rolled steel, at 124 pieces per minute.

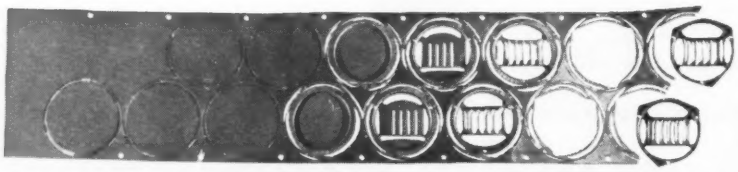
THREE OR FOUR conventional presses would have been required to produce this part, it is estimated by Emil Gaul, Grand Haven vice president. Among the features he likes about the Double Crank are: unequalled flexibility afforded by the large bed area, rapidity of die change, inching control and safety devices.

"Definitely improved our competitive position," is the way Mr. Gaul sums up the performance of his Henry & Wrights. They can improve productivity and work quality in your plant, too. Write for our catalog.

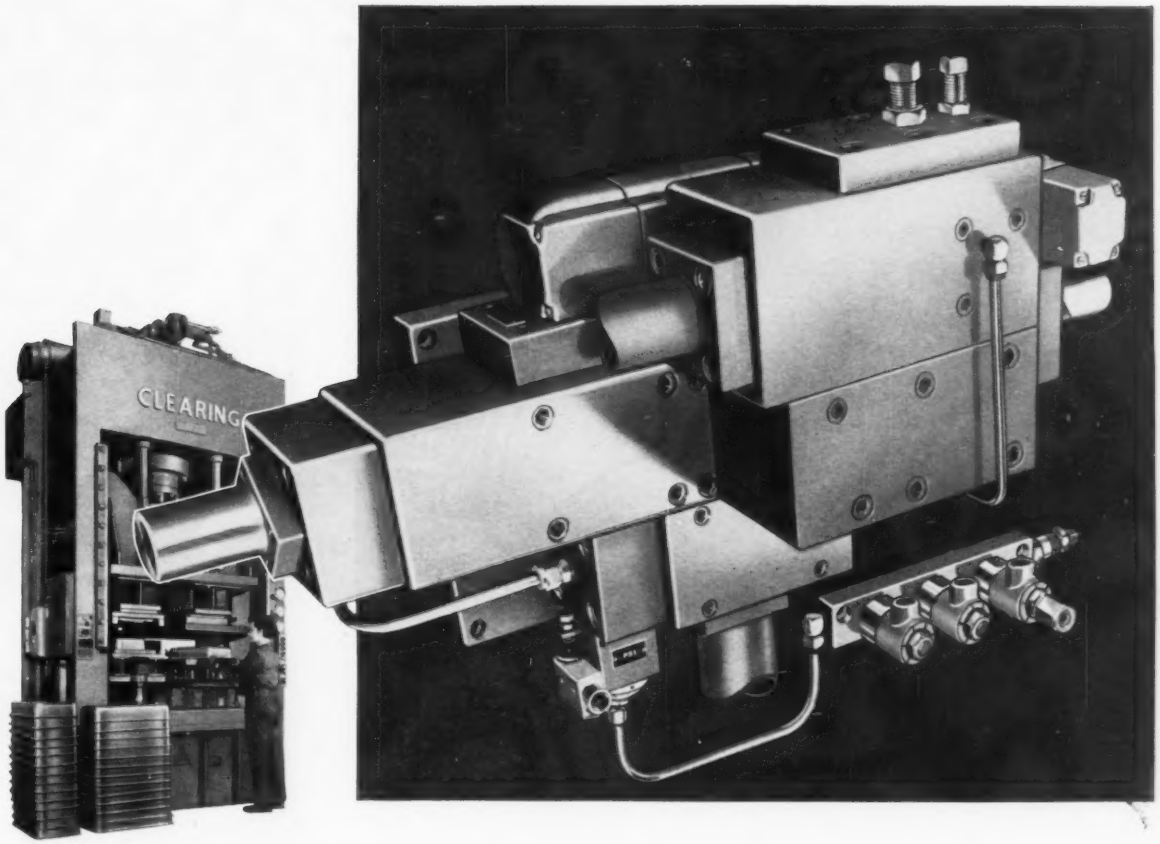
HENRY & WRIGHT

Division of Emhart Mfg. Co.

Hartford, Connecticut



Six- and seven-station twin die lances, flattens, draws, pierces, forms and blanks out.



The heart of steel that can step up the pulse of your drawing operations

To paraphrase Hamlet, *the thousand natural shocks that a press*—a hydraulic press, that is *—is heir to,* raises havoc with pipe joints and valve connections. That's why Clearing engineers designed the compact operating valve shown above.

In this solid steel unit all operating valves are manifolded, reducing the amount of intervalve piping.Valve bodies are machined from forged steel and all chambers and ports are bored from solid. The unit is firmly mounted to the oil reservoir, thus simplifying inspection and servicing. Valve bodies and spools are free to move under all conditions without binding.

If your production requires hydraulic presses, investigate Clearing hydraulics. Find out about the new high speed approach and return stroke cycles that step up production rates. Find out about the remarkable tonnage and stroke controls. Complete information on Clearing Hydraulics is yours for the asking.

Write for your personal copy of Bulletin 231, Clearing Hydraulic Presses.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • *Division of U.S. INDUSTRIES, INC.*

6499 WEST 65th STREET • CHICAGO 38, ILLINOIS • HAMILTON PLANT, HAMILTON, OHIO

For more information fill in page number on Inquiry Card, on page 257

This Scott Wiper is being used with a solvent to clean inside the necks of TV tubes at Tung-Sol Electric, Inc. Scott Wipers are 2-ply paper sheets, with plies welded for extra strength. Their specially processed surface, lint-free, makes Scott Wipers ideal for such work.

WIPER PROBLEM? Look what Tung-Sol did with Scott Wipers!

Tung-Sol Electric, Inc., Newark, N.J., got tired of collecting, sorting, storing and laundering rags. They switched to Scott Wipers—got improved wiping, and cut overall wiping costs.

Tung-Sol uses soft, absorbent Scott Wipers throughout its operation. Ideal for industrial wiping jobs, Scott Wipers are chemically treated for excellent wet strength—can even be used with solvents. Lint-free, they're used regularly at Tung-Sol for cleaning out the necks of TV tubes. In the machine shop, Scott Wipers also do a better job on stock, tools and machines.

Scott Wipers are easily disposed of—and when they're fresh out of their "pop-up" box, they have no clinging metallic particles to scratch or cut. Employees appreciate their cleanliness and softness for wiping hands and faces. Want more details? Call your local Scott representative or distributor. Or write Scott Paper Company, Dept. M-73, Chester, Pa.

SCOTT PAPER COMPANY

Makers of the famous Scott paper products you use in your home.
Consult your local TV schedules for Scott's program, "Father Knows Best."

HY-PRO specialized tap engineering tells you

which tap where

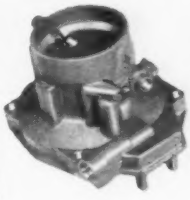
for lowest cost per hole

New alloys, new plastics, new tooling set-ups, and mounting production demands pose new problems daily in tap selection and use. HY-PRO tap engineering service provides prompt answers . . . the *right* answers that mean steady savings in tap expense, in time loss on the line, in reduced parts spoilage.

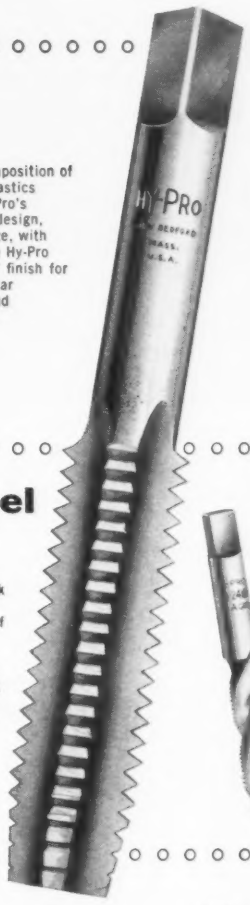
in plastics

Abrasive composition of most hard plastics requires Hy-Pro's multi-fluted design, .0025 oversize, with the exclusive Hy-Pro "Hardernell" finish for maximum wear resistance and free-cutting.

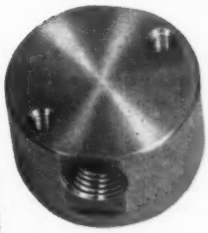
in die castings



Relative softness of alloys used causes tendency to close in and bind the tap. Hy-Pro's 2 flute spiral point oversize design meets these conditions, — provides free-tapping, clean threads.



in stainless steel



Hy-Pro spiral point design provides high-hook angle for most efficient cutting of this metal, and maximum tap strength. Ferrox surface treatment counteracts chip welding.

in aluminum

Hy-Pro's spiral (1) flute tap lifts chips out, gives best results in blind holes. Hy-Pro's spiral point design (2) is recommended for through holes. Chrome plate or nitride surface treatment resists abrasive effect of most aluminum alloys.

HY-PRO

REG. U. S. PAT. OFF.

TAP ENGINEERING SPECIALISTS

What's your tapping problem?

Hy-Pro Tap Engineering Specialists can help you correct tapping troubles — and can often point out opportunities to cut costs in tapping operations you've considered satisfactory. It costs nothing to consult Hy-Pro Specialists, and records prove that in 8 out of 10 cases, their advice will pay steady dividends in savings. Write or phone: Hy-Pro Tool Company, Dept. E, New Bedford, Mass.

CALL YOUR LOCAL **HY-PRO DISTRIBUTOR**
FOR STANDARD TAPS FROM STOCK
SPECIAL TAPS MADE TO ORDER

HY-PRO TOOL COMPANY · NEW BEDFORD, MASS., U. S. A.

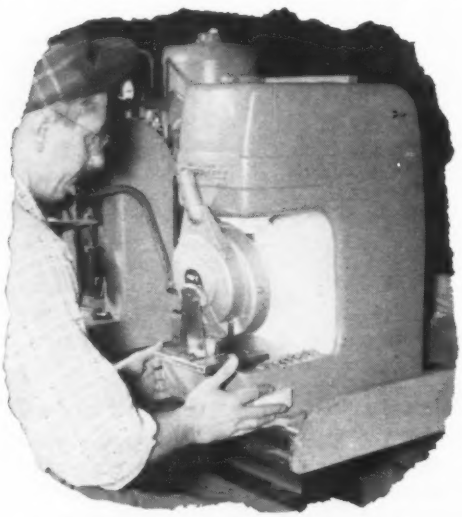
For more information fill in page number on Inquiry Card, on page 257

Investigate Production Savings

made possible by Denison's 1-Ton Multipress

No scrap Riveting electrical controls in bakelite cases with the 1-ton Multipress has virtually eliminated breakage for Therm-O-Disc, Inc., Mansfield, Ohio. The press ram automatically reverses when the pre-set pressure of 900 pounds is attained.

Twice the output Three 1-ton Multipresses are used for broaching, burnishing and stripping operations at Lamson & Sessions, Cleveland, Ohio. Production was doubled over previous methods; pinpoint accuracy is obtained with semi-skilled operators.



Higher quality Peening studs less than ¼" long was a ticklish job made easy by the 1-ton Multipress. Health-Mor, Inc., Cleveland, Ohio, manufacturer of vacuum cleaner parts, has found that ease of Multipress operation greatly improves product quality.

Let Multipress point the way to production economy

DENISON Hydr OIL ics

For complete information, write:

DENISON ENGINEERING DIVISION

American Brake Shoe Company

1244 DUBLIN ROAD • COLUMBUS 16, OHIO

Sellers grinder produces scientifically correct drill point

quickly, easily, economically!

Here's drill-point grinding that can actually lift the performance level of all the drilling equipment in your shop — it's that much better.

The Sellers machine grinds one lip completely and then, with every condition the same, grinds the second lip after rotating the drill in the chuck 180 degrees. The drill is held so that, regardless of eccentricity in the drill or wear in the chuck, the point is exactly on center. When the drill alone is revolved 180 degrees in order to grind both lips, there is no chance of any machine error creeping into the result. What's more, the chisel point has great compression strength and fine heat-conducting qualities.

The point generated is scientifically correct, with the lip clearance increasing proportionately from the periphery to the chisel point. This means drill points cut faster, longer . . . drill through more inches of metal per grind and produce holes that are true cylinders of accurate size.

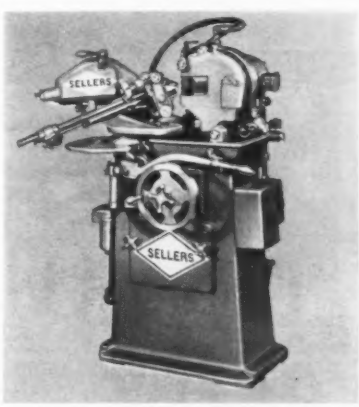
During grinding the chuck is rotated, sweeping the axis of the drill through the necessary arc. At the same time, the drill lip can be moved back and forth across the face of the wheel by a lever-actuated slide. This traverse motion permits very rapid removal of metal.

The Sellers machine is fast and simple to operate. So much so, that an unskilled operator can produce more drills than an experienced hand grinder.

CM-19

For more information about this unique machine, send for a copy of Bulletin 4201.

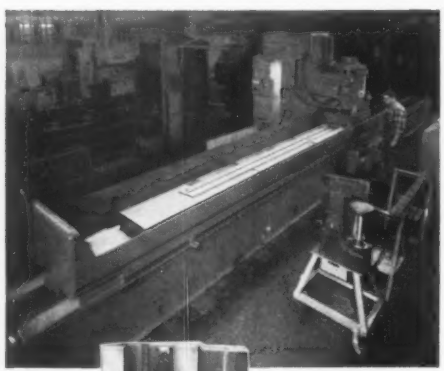
CONSOLIDATED MACHINE TOOL DIV.
FARREL-BIRMINGHAM COMPANY, INC.
Rochester 10, New York
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.



For more information fill in page number on Inquiry Card, on page 257

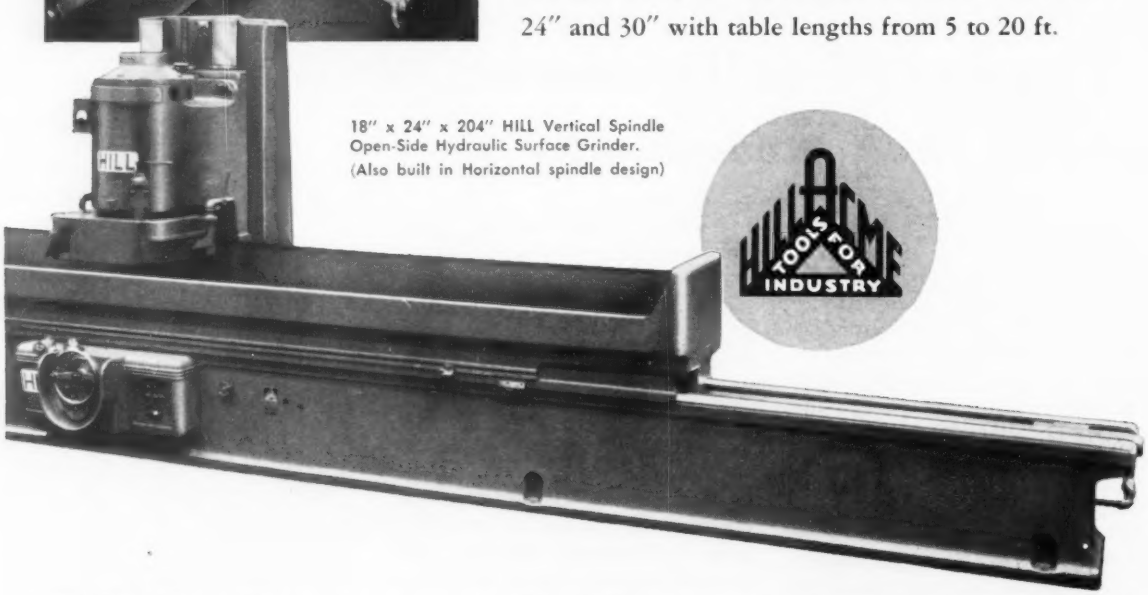
EVERY HEAVY DUTY SURFACE GRINDER SHOULD HAVE:

- *Open-side Accessibility*
- *100% Hydraulic Table Drive*
- *Built-in Spindle Motor*
- *Centralized Controls*
- *Low Pressure Hydraulic System*
- *One-Shot Lubrication System*
- *Adequate Safety Devices*



BUT THEY DON'T—

So GET A HILL with ALL the above features *plus* many other design improvements which insure rapid stock removal and accurate grinding of flat surfaces within the periphery of the grinding wheel. HILL Vertical Spindle grinders are built in table widths of 18″, 24″ and 30″ with table lengths from 5 to 20 ft.



18″ x 24″ x 204″ HILL Vertical Spindle Open-Side Hydraulic Surface Grinder. (Also built in Horizontal spindle design)

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

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"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING, TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

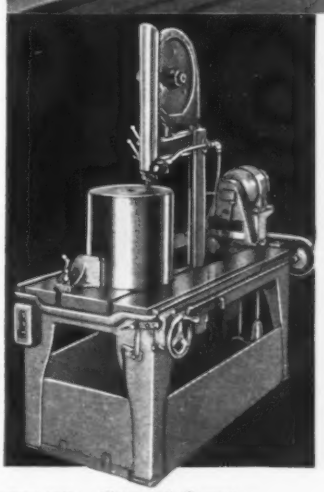
MARVEL NO. 8 BAND SAW makes a tough job EASY...

FLOOR TO FLOOR IN 5 HOURS... no special jigs, fixtures or set-up required

The versatility, simplicity of operation and unmatched efficiency of a MARVEL No. 8 Universal Metal Cutting Band Saw makes it the best all-around saw you can buy.

Take the job illustrated, as an example. Three equally spaced re-entrant cuts were required to segment a large, heavy die forging. The work was merely placed on the table between the vise jaws with the first lay-out line positioned to bisect the blade. Feed pressure was set on the direct-reading scale and the cut started. On a MARVEL No. 8, the work is always stationary and the blade is fed into the work; the cutting edge of the blade is always square with the table throughout its full feed traverse, which eliminates the need for special fixtures. The pre-set Automatic Overload-Relief Power Feed kept the blade moving into the work only as fast as it could freely remove the metal; as the vertical length of the cut decreased, the blade was automatically fed faster, thus increasing cutting speed. Upon completion of a cut, the blade was rapidly returned to its starting position by a rapid traverse handwheel located at the operator's position. Succeeding cuts were made in the same manner, with the same ease and speed.

Jobs like this aren't done every day, but they serve to emphasize the versatility of the MARVEL No. 8, a truly universal metal cutting saw. If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.



ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. · CHICAGO 39, ILL.

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

S-1302

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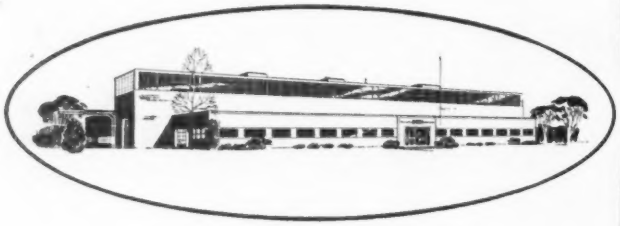
headquarters for metal forming...

"Complete Metal Forming Service" is a byword at the Cyril Bath Company. Recognized leaders for over 40 years, Bath manufactures a complete line of Power Presses, Press Type Brakes, Tangent Benders, Multi-Form Sequence Presses and Radial Draw Forming Machines.

If you need production, the Metal Form Division will produce your parts to specification. Its Engineering Department and complete plant facilities are at your disposal.

Inquire today about Bath's complete service. Your inquiry, prints or samples of your specific requirements will receive prompt attention.



Send today for literature on Bath products or service. Catalogs on Stock Press Brake Dies, Power Press Brakes, Bath Press Type Brakes, Tangent Bending Sequence Presses, Aircraft Contract Forming or Stretch, Compression and Radial Draw Forming are yours for the asking. They contain a wealth of information on metal forming from simple blanking and bending to forming of complex parts.

THE CYRIL BATH COMPANY

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(LOCATED IN THE GREATER CLEVELAND AREA)
Manufacturers of Radial Draw Formers • Dies • Tools
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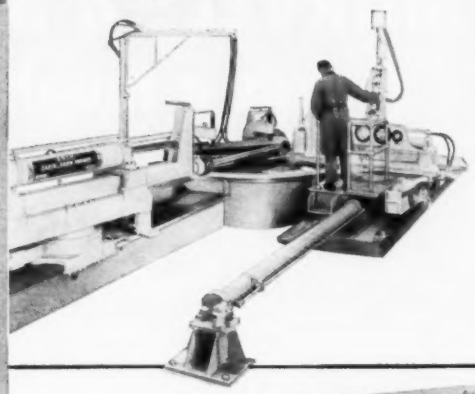
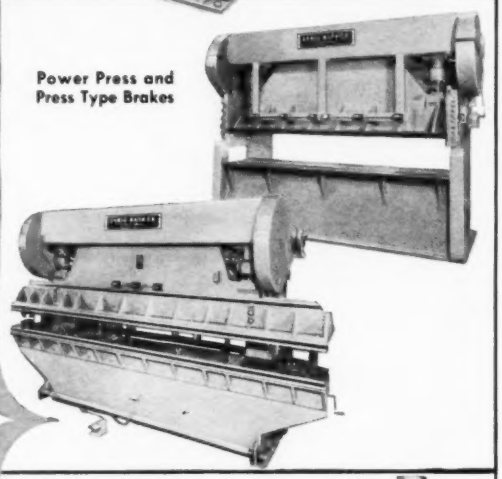
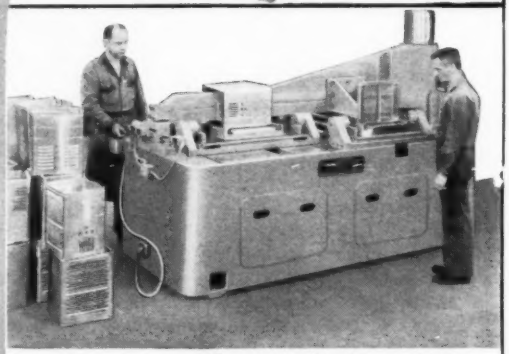
Stretch, Compression or Radial Draw Forming Machines

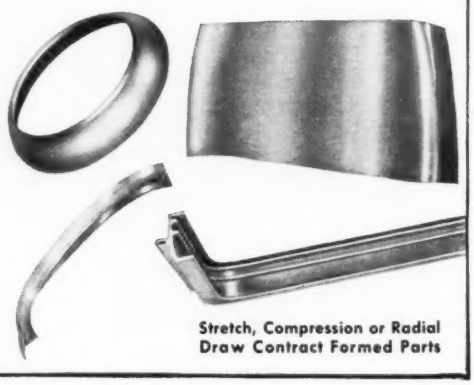


Power Press and Press Type Brakes

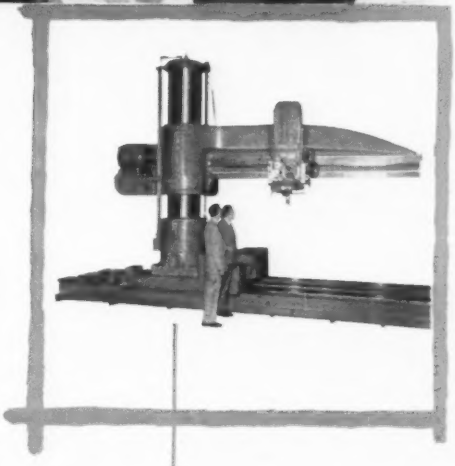




Tangent Bending Sequence Presses



Stretch, Compression or Radial Draw Contract Formed Parts



Specialists do the job better

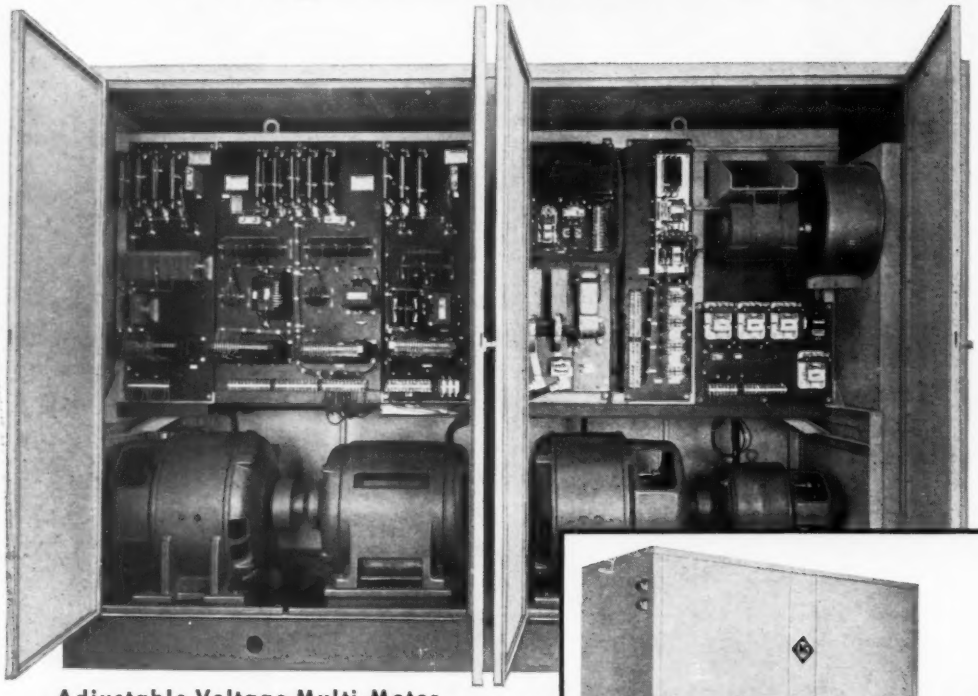
Where skill and knowledge are vital, you feel safer with specialists on the job. Carlton has specialized in radial drill research, engineering and manufacturing since 1916. This close contact with—and intimate knowledge of industry's drilling requirements—has produced a wide line of the most modern and up to date radial drills. Made in arm lengths from 3-ft. to 12-ft., column diameters from 9″ to 26″. Programming, pre-select, partial pre-select and manual speed-feed controls, plus special bases, tables and jigs available for additional productivity. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton

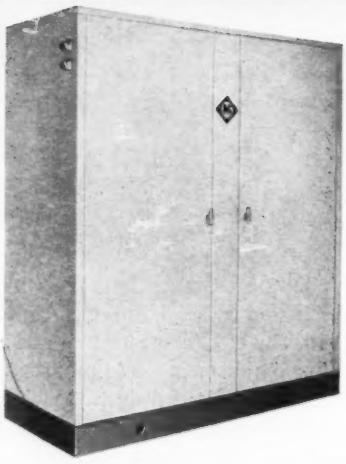
SPECIALISTS IN RADIAL DRILLS

There's MORE dependable speed control

- high response
- high shock resistance
- no fragile parts
- no maintenance



Adjustable Voltage Multi-Motor Package Drive is ideal for many industrial applications. Self-ventilation keeps unit clean, minimizes maintenance.



Size 3 Adjustable Voltage Power Unit rated 30 hp, of standard construction. Magnetic amplifier excitation provided.

Every one of the design features of the Allis-Chalmers Adjustable Voltage Package Drive assures you an easy, dependable means of power conversion.

Key to Package Drive dependability is the use of a magnetic amplifier to excite the field of the power unit m-g set. Sturdy and simple, this amplifier has no moving parts to wear out . . . no fragile components to be affected by vibrations. AND — there's no wasteful "warm-up" time needed. At the turn of a dial, you get immediate speed control.

Cost-saving assembly

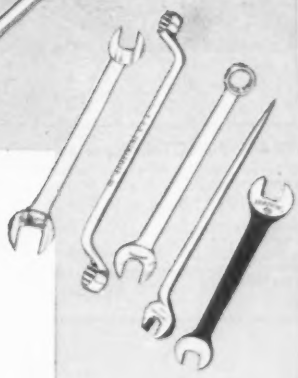
M-g set and control components are assembled in the power unit enclosure at the factory — saving you installation costs. Enclosures used for 30 through 200-hp units are completely collapsible and may be easily disassembled without loss of rigidity. Larger units have separately driven blowers to provide positive ventilation and pressure even when unit is idle.

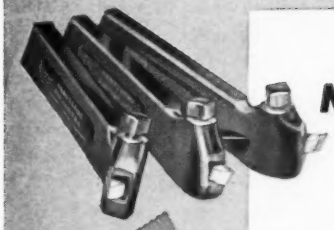
Available in units from 5 to 200 hp, the package drive is ideal for any application requiring adjustable speed. Contact your nearby Allis-Chalmers sales office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS A-5270

ARMSTRONG

Quality TOOLS

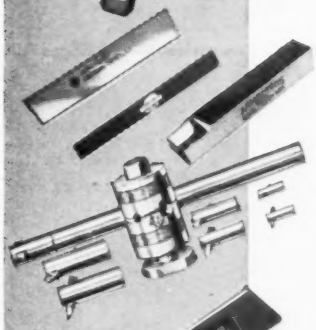




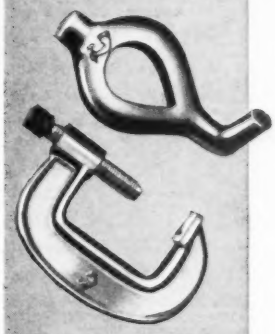
More than meets the eye

There are extra values in ARMSTRONG TOOLS that become apparent only with use.

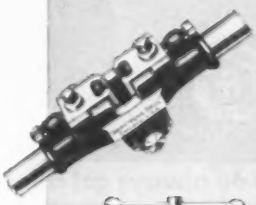
TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.

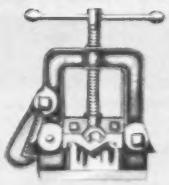


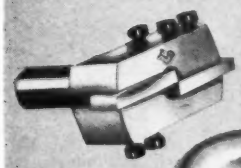
STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.



UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.







ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 WEST ARMSTRONG AVE. • CHICAGO 30, ILLINOIS

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Niagara Falls, N. Y.
Crane Packing Co., Morton Grove, Ill.

ABRASIVES, Discs
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carborundum Co., Niagara Falls, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg Philadelphia, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Niagara Falls, N. Y.
Crane Packing Co., Morton Grove, Ill.
Cratex Manufacturing Co., 81 Natoma St., San Francisco, Calif.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Elmes Eng. Div., Paddock Rd. & Tennessee Ave., Cincinnati, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia Conn.
Watson-Stillman Co., Roselle, N. J.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co. New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

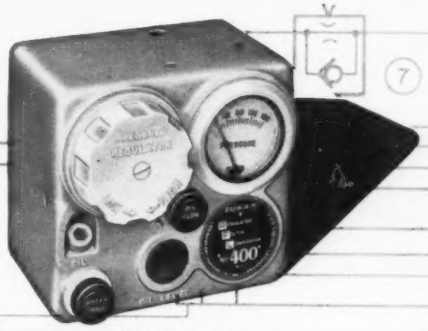
ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer Toledo 1, Ohio.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
General Electric Co., Schenectady, N. Y.



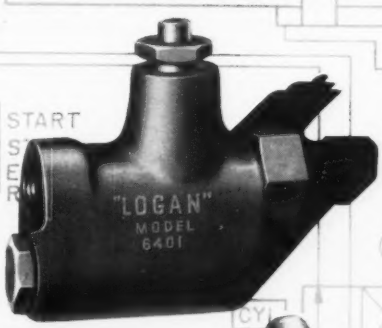
LOGAN MODEL 400 RFL UNIT
REGULATES, FILTERS, LUBRICATES

LOGANSQUARE CYLINDER
FOR AIR OR OIL SERVICE

Look to Logan

FOR POSITIVE, CONTROLLED

POWER



LOGAN MODEL 6401
ADJUSTABLE AIR SPEED
CONTROL VALVE

LOGAN MODEL 6540 4-WAY, 2-POSITION
AIR CONTROL VALVE

Yes, you can always depend on Logan for the most dependable components to effectively serve your air circuit requirements.

FREE *SEND FOR THE "LOGAN CALCULATOR"*

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
810 CENTER AVENUE, LOGANSPORT, INDIANA

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- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-5-1 ULTRAMATION CYLINDERS
- ☐ 51 PRESSES
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- ☐ 62 SURE-FLOW PUMPS
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 and 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 70-1 CHUCKS
- ☐ ABC BOOKLET
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COMPANY _____

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manual, oil or air-actuated ...for unbiased* friction clutch recommendations, consult Twin Disc!

Manually-Actuated

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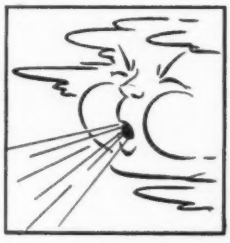

Air-Actuated

*Unbiased recommendations . . . because whether your operation calls for a manual-, oil-, or air-actuated clutch, all are available from Twin Disc. More important, Twin Disc also makes a complete line of fluid drives, including torque converters—both single-stage and three-stage—for applications from 30 to 1000 hp . . . as well as fluid couplings for engines and motors from ¾ to 850 hp. For every industrial power transmission requirement—friction or fluid—consult Twin Disc *Specialists*.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

ARC WELDERS—See Welding Equipment, Arc

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

BABBITT

American Crucible Products Co., Lorain, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Gisholt Machine Co. Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES

Haynes Stellite Co., Kokomo, Ind.
New Departure Div., Bristol, Conn.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous

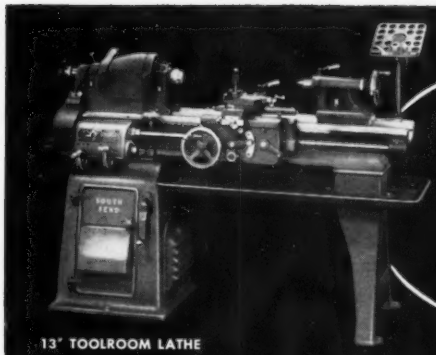
American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron, Mich.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BAR STOCK AND SHAFTING, Steel

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Cumberland Steel Co., Cumberland, Md.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES

Fafnir Bearing Co., New Britain, Conn.



13" TOOLROOM LATHE

SOUTH BEND 13" LATHES

Illustrated — 13" x 5' bed Toolroom Lathe, less motor and controls, f.o.b. factory. $2139

for accurate, low-cost machining

South Bend 13" Lathes are popular where there is a variety of precision parts to be machined. Costs drop as their accuracy and efficiency keep production flowing fast even on the "headache" jobs. Operators prefer them for their simplicity and practically effortless handling. Also, set-ups and change-overs are made so quickly and easily that down-time is held to a minimum.

Now is the time to find out how these quality-built lathes can also bring you better machining at lower costs. Let your near-by South Bend distributor show you how they can ease your production, toolroom and maintenance machining problems. Or, mail coupon for literature on the 13" Toolroom and Engine Lathes.

SPECIFICATIONS

Swing—13⅛" over bed and saddle wings, 8" over saddle cross slide.

Distance Between Centers—28", 40" and 52".

Collet Capacity—1" maximum (collets interchangeable with 10"-1", 14½", 16" and 16-24" South Bend lathes).

Spindle Bore—1⅜".

Spindle Speeds—Six to Sixteen 40 to 940 r.p.m. or 20 to 940 r.p.m. approximately.

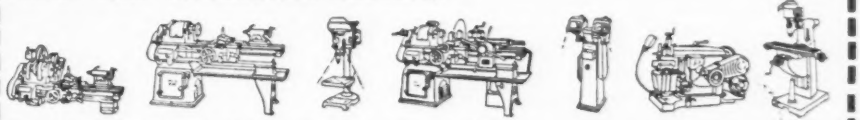
Longitudinal Feeds—48 R.H. or L.H., .0015" to .0841".

Cross-Feeds—48, .0006" to .0315".

Thread Cutting—48 R.H. or L.H. pitches, 4 to 224 per inch.

SOUTH BEND

PLEASE SEND INFORMATION CHECKED:



☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ ½" & 1" Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7" BENCH SHAPERS ☐ MILLING MACHINES

Name_____ Street_____

City_____ State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

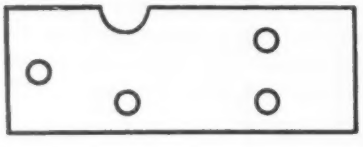
How to SAVE on STAMPINGS

If you buy stampings, it will pay you to read these important suggestions. They will help *us* to help *you*... (1) with faster deliveries... (2) with lower prices.

Your blueprint and the data on it are our bible! We must assume that all tolerances and limitations shown are strictly essential to the functioning of the finished part.

We want to—and we will—give you *exactly* what you require. But if there are unnecessary restrictions or requirements you'll be paying more than you need to. You don't like that. We don't either.

FOR EXAMPLE:



Here's a simple, hypothetical stamping. Tolerances for all the holes and the slot are specified "plus or minus .001"—so we assume such close tolerances are essential to the proper functioning of the piece.

In the light of these close tolerances, your part would cost you $X per M. In effect *you* set the price. We don't. But your parts, when you get them from *this* shop, will meet every one of those specs.

Now, from long experience, we know that in many cases like this some of the requirements *could* be relaxed.

Let's say, for example, that plus or minus .003 is actually adequate for 3 of the 4 holes and the slot. It's comparatively easy to hold to .001 on *one* hole if there's a latitude of plus or minus .003 on the other holes and the slot.

How would these modifications affect what you pay? Your cost would be a *fraction* of $X per M, probably a *small* fraction. That would make *you* happy, *and* us too.

OTHER WORTHWHILE POINTS:

Quantities. Order maximum. Higher quantities mean lower unit cost. Three runs of 2,000 can't cost the same as one run of 6,000.

Short Runs. If you want *short run* stampings, try to set your tolerances accordingly. It isn't practical to hold the same tolerances in Short Runs as in Production Runs.

De-burring. If you must have *all* burrs removed that's readily done. But if *smooth pieces* will do, don't specify "Remove all burrs." You'll save money.

Punched Holes. When specifying hole size try to specify a standard punch size. Saves you the cost of a custom made punch.

A WORD TO THE PURCHASING AGENT:

When requirements or specs appear more stringent than necessary, we question them with the customer. But this takes time. **Therefore—to help save time and money—we suggest you do not include any specification, tolerance or limitation for which you are not willing to pay.**

For more complete information, send for our free 12-page booklet, "Service in Stampings"

—STAMPINGS DIVISION—

"One Piece or a Million"

3903 Union Street, Glenbrook, Conn.

LAMINATED SHIM COMPANY, INC.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless

American Crucible Prod. Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.
Timken Roller Bearing Co., Canton, Ohio.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BELTING, Transmission

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCH CENTERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENCHES AND STOOLS

South Bend Lathe Works, South Bend 22, Ind.

BENDERS, Bar, Tube, Channel, etc.

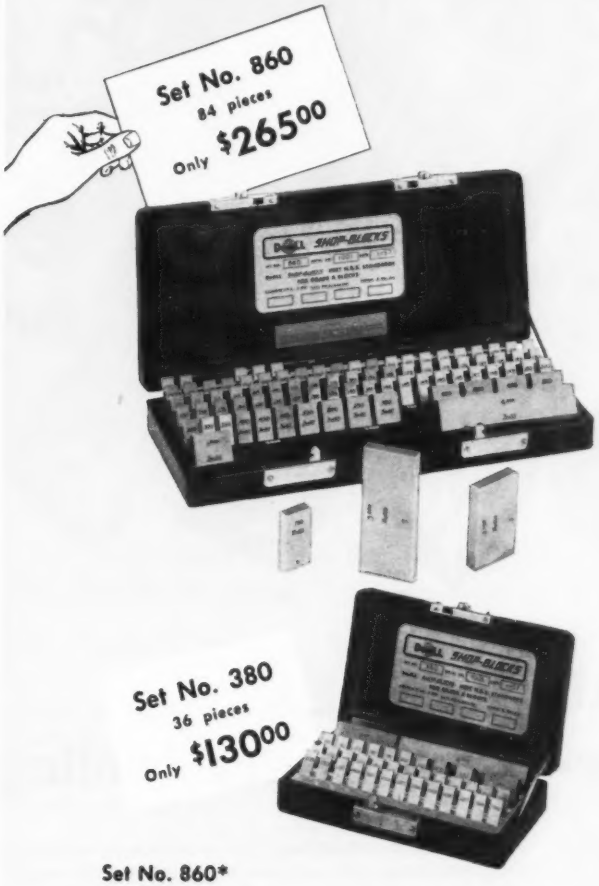
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Greenlee Bros. & Co. 2136—12th St., Rockford, Ill.

(Continued on page 292)

"A" Grade Working Gage Blocks . . .

at "B" Grade Prices

NEW DoALL SHOP-BLOCKS



ACCURACY:	+ .000006" − .000002"
FINISH:	0.8 AA or better
FLATNESS:	.000004"
PARALLELISM:	.000004"
HARDNESS:	65 Rc

. . . Superior Accuracy for Shop Measurements

No shop can afford to rely on less than Bureau of Standards A Grade gage block accuracy to maintain adequate Dimensional Control by Today's Standards. This accuracy is possible, practical and *here now*, at a price *any* shop can afford. The new low priced DoALL Shop Blocks are guaranteed equal to Bureau of Standards A Grade specifications.

Check the prices, compare the specifications with any other "working" gage blocks. Nowhere else will you find genuine A Grade blocks priced for shop use.

DoALL SHOP BLOCKS meet the realities of today's precision tolerances required right at the bench, job or machine. They represent DoALL's decision to completely discontinue manufacture of B grade blocks, as inadequate for today's dimensional control needs. They provide working accuracies that will save you valuable time, effort and waste . . . give better control needed for shop measurements.

Your DoALL Store is taking orders now for the new SHOP BLOCKS. Call DoALL today. Learn more about these new gage blocks that insure unprecedented working accuracies at a price unmatched anywhere—only DoALL offers you A Grade SHOP BLOCKS at less than B Grade prices!

Set No. 860*
84 pieces
.0001" Series— 9 Blocks .1001" thru .1009"
.001" Series—49 Blocks .101" thru .149"
.050" Series—19 Blocks .050" thru .950"
1.000" Series— 4 Blocks 1.000" thru 4.000"
Quarter tenth Series—3 Blocks .100025", .100050" .100075"

Set No. 380*
36 pieces
.0001" Series—9 Blocks .1001" thru .1009"
.001" Series—9 Blocks .101" thru .109"
.010" Series—9 Blocks .110" thru .190"
.100" Series—5 Blocks .100" thru .500"
1.000" Series—3 Blocks 1.000" 2.000" 4.000"
Half tenth Series—1 Block .10005"

* .050" or .100" steel or carbide wear blocks available at slight extra cost.

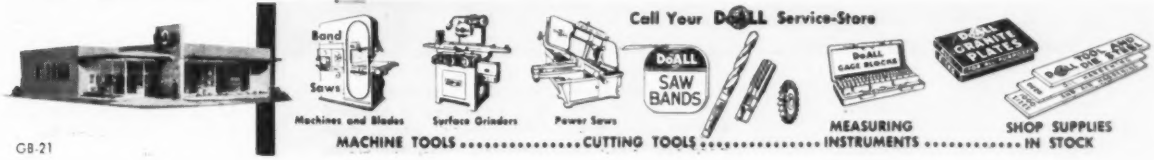
Better Blocks for Inspection and Laboratory, Too!

New DoALL blocks for inspection and lab use having surface finish of 0 to 0.09 AA are made in A + and AA grade accuracies. For ultra precision work DoALL offers AAA grade accurate to one millionth of an inch. ASK FOR CATALOG.

Your DoALL Store is headquarters for the best in measuring instruments

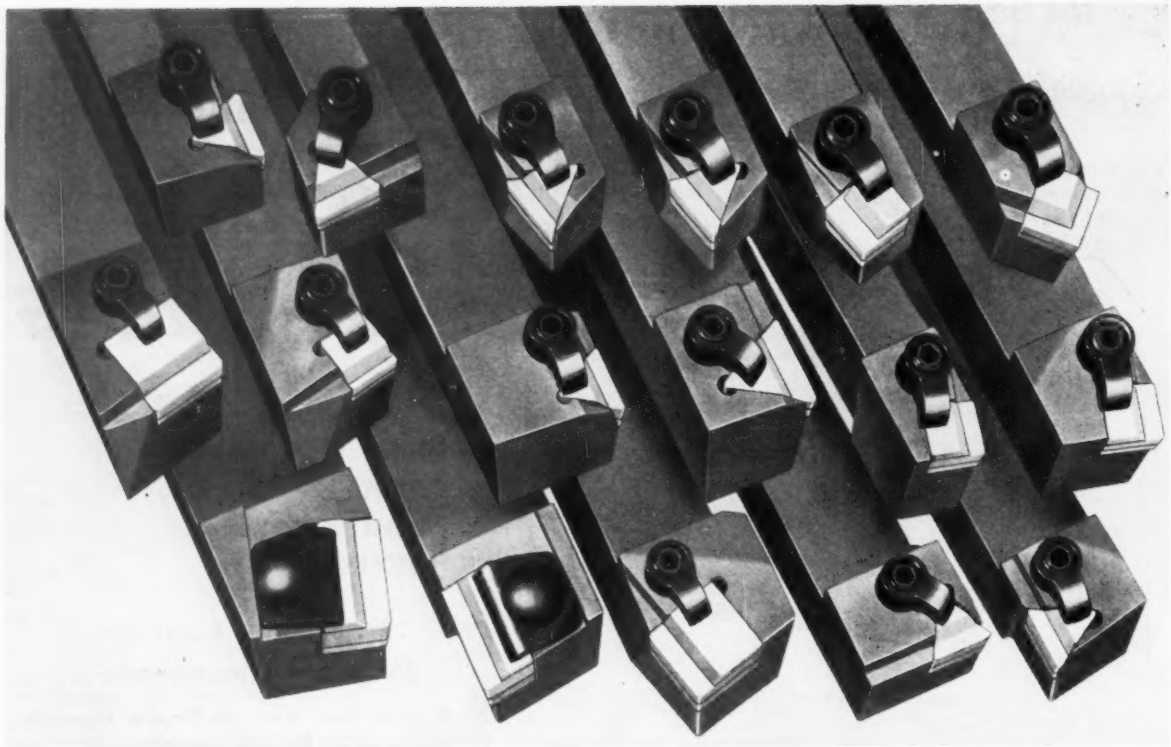
ASK FOR LITERATURE . . . call DoALL or write:

DoALL The DoALL Company
Des Plaines, Illinois



Call Your DoALL Service-Store

GB-21



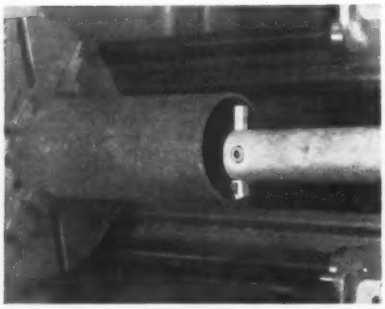
KENNAMETAL*—KENDEX*... the leader in "throw-away" insert tooling

Starting with only six styles several years ago, the Kendex* line of clamped "throw-away" insert type tooling has grown to 27 styles and over 200 tools . . . plus many special designs as illustrated on these pages.

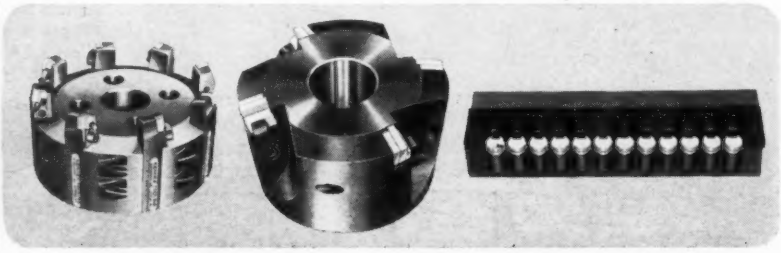
This rapid acceptance of the Kendex principle for more and more machining operations can mean only one thing: Kendex Tooling offers users certain exclusive advantages and a better return on their investment than any other metal-cutting tools available.

Today there are Kendex Tools for practically any metal-cutting operation . . . for use on all types of machines: turret lathes, engine lathes, planers, milling machines and automatic cycling machines. You can have positive or negative rake tools and regular or precision inserts of the right size, shape and grade for top performance on every job . . . for roughing, finishing or interrupted cutting. Every Kendex Tool permits fast indexing of inserts or change of chipbreaker without resetting the tool . . . *eliminates regrinding of inserts and chipbreakers* . . . permits use of harder grades of carbides for higher speeds . . . plus these additional features:

- a wide variety of "throw-away" inserts . . . utility ground (top and bottom) or precision ground (all



Boring bar equipped with standard Kendex indexable inserts (square or triangular), chipbreakers, and insert seats.



Eight standard Kendex Tools adapted for face milling and deep chamfering.

Special 4-insert boring head with adaptation of standard "throw-away" inserts, chipbreakers, shims, and clamp mechanism.

Kendex multiple grooving tool, with 12 turnover inserts. Cutting edges easily indexed—solid Kennametal seats.

surfaces) . . . in round, square or triangular shapes . . . available in eight different grades.

- Solid Kennametal seats are standard on all Kendex holders . . . Kennametal chipbreaker plates optional for all styles.

Now Kendex Boring Bars bring all the advantages of the Kendex principle to turret lathe boring operations

Here are some Kendex advantages on boring operations: the cutting point is brought down to the center line of the bar; greater support of the cutting edge is provided; better chip control; higher speeds for better boring results; greater resistance to thermal shock and to edge wear at higher speeds. Cutting inserts index quickly and accurately without resetting tool thus reducing machine downtime. Costly regrinding is eliminated. Production is increased.

New! Small Kendex Tools for light machining . . . boring

Another variation of the popular Kendex Tooling is the small ½" square by 4½" Kendex holder to use small inserts at a 5° negative rake angle. This is available in four styles for all light machining on high production operations—especially boring. These tools are ideal for using the harder and more crater-resistant grades of Kennametal. The smaller inserts help reduce tooling costs.

All advantages of the Kendex principle are provided by the new line of Kendex Roller Turner Tools. These tools provide constant center height, accurate radius control, ease of tool changing, uniform chip control, higher production and lower cost per cutting edge. Solid Kennametal seat is standard . . . chipbreaker optional.

Why not investigate how you may use Kendex Tooling to speed production . . . reduce tool costs. A Kennametal engineer will help you apply Kendex Tools to your operations. He works exclusively with Kennametal Tooling . . . applying and servicing it. Call your nearest Kennametal office or write now to KENNAMETAL INC., Latrobe, Pa.

*Trademarks

C-3018

Kendex Boring Bars are available in two styles: (1) bar with 15° lead angle and square insert; (2) bar for turning to a square shoulder with a triangular insert.

½" square Kendex holders for small "throw-away" inserts are available in four styles with Kennametal seats and chipbreakers.

KENDEX ROLLER TURNERS

Kendex Roller Turner holders, with shank sizes for standard Warner & Swasey, Gisholt and Jones & Lamson tools.

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KENNAMETAL
. . . Partners in Progress

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Cincinnati Shaper Co., Hoppie & Gerrard, Cincinnati, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.

BENDING MACHINES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Elmes Eng. Div., Paddock Rd. & Tennessee Ave., Cincinnati, Ohio
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.

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Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., Roselle, N. J.

BENDING ROLLS
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.

BLAST CLEANING EQUIPMENT
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Pangborn Corp., Hagerstown Md.

BLOWERS
Buffalo Forge Co., 490 Broadway Buffalo, N. Y.

BLUING LAYOUT
Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BLUEPRINT MACHINERY & ACCESSORIES
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Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Ottemiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridegport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Michigan Drill Head Co., Van Dyck, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
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Wadell Equipment Co., Clark, N. J.
Wales-Strippit Co., No. Tonawanda, N. Y.

BORING MILLS, Horizontal
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
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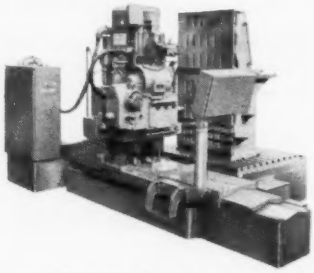
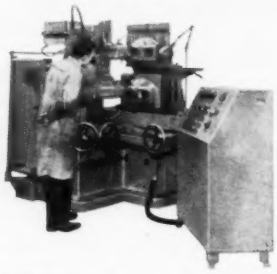
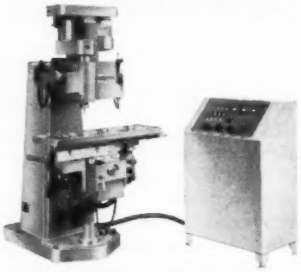
A P&W Tracer-Controlled MILLER FOR EVERY JOB



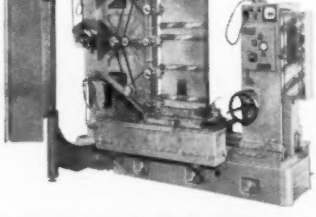
KELLER TYPE BG-21 . . . a powerful, versatile machine in a range of sizes from 5′ x 2½′ to 10′ x 4′, in single and 2-spindle models.



KELLER TYPE BL . . . a compact, powerful Tracer-Controlled Miller for work within the range of 36″ x 20″. With all new Keller features. Single and 3-spindle models.

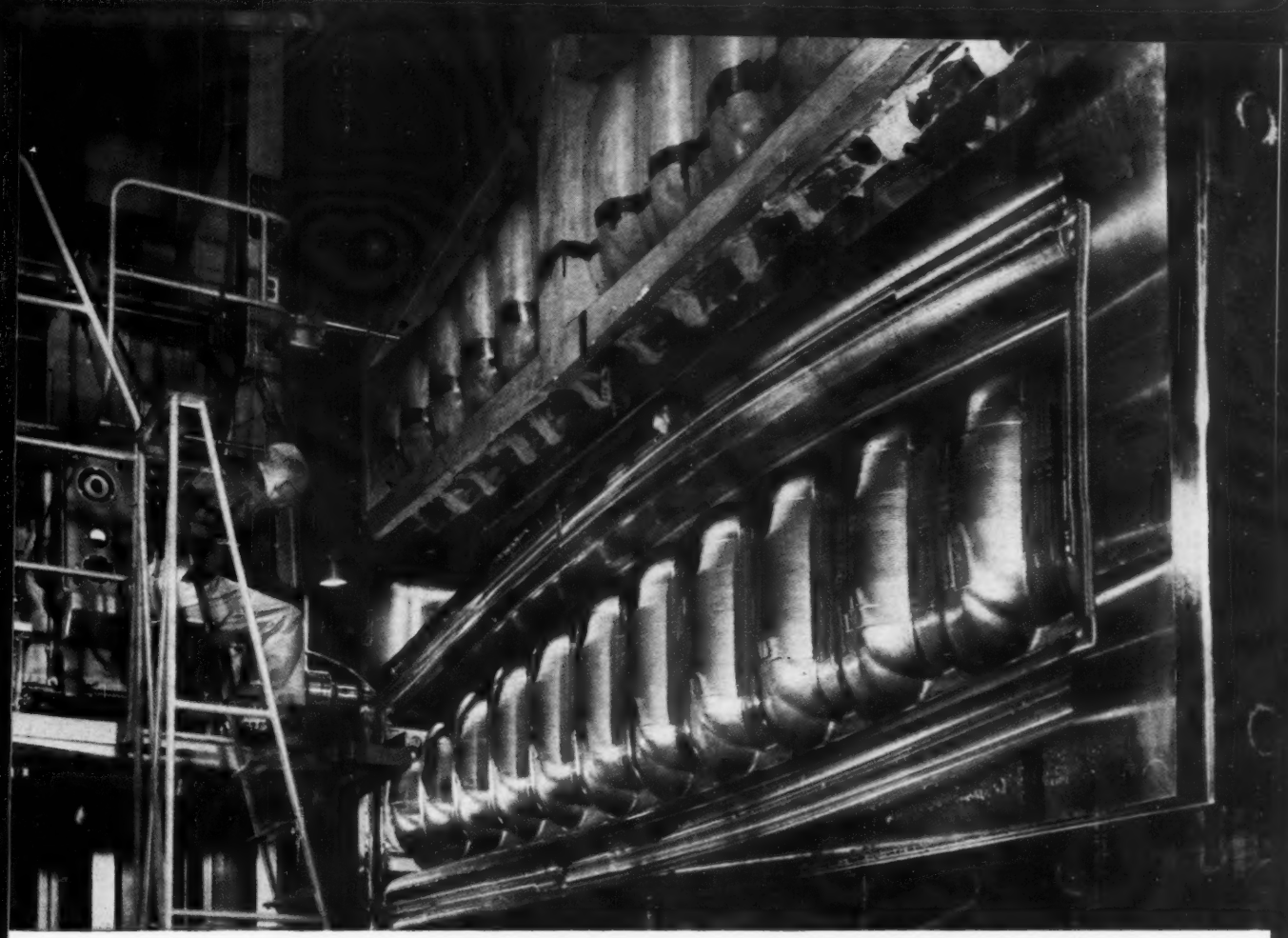


VELVETRACE® MILLING MACHINE . . . duplicates the finest detail with extreme precision. New, non-contacting tracer control cannot damage the softest, most fragile 3-dimensional models.



AUTOMATIC DUPLICATION MACHINES . . . automatically reproduces original forging dies and glass or plastic molds with remarkable precision and detail. Two versions, one for molds, one for dies, with 1, 2 or 4 spindles.

For more information fill in page number on Inquiry Card, on page 257



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To machine the WORLD'S LARGEST DIE,

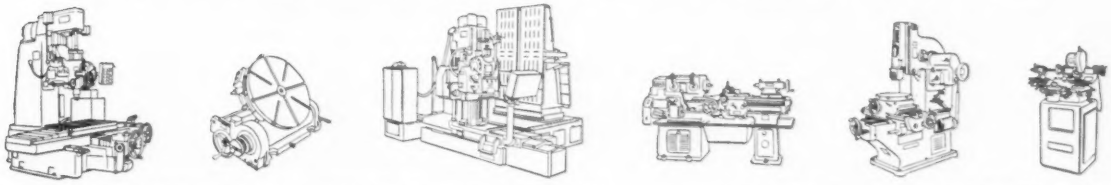
ALCOA chose the Keller . . .

. . . AUTOMATIC TRACER-CONTROLLED MILLING MACHINE

Consisting of two halves, each weighing 30 tons, this is the world's largest closed die block. Designed to forge aluminum backbones of fuselage and wing structures for the new multi-jet Martin SeaMaster, this giant die was produced on a P&W Keller BG-22 at the U.S. Air Force Heavy Press Plant operated by Aluminum Company of America.

Chances are that your own workpieces aren't as large as this die, but there is a Pratt & Whitney Keller Automatic Tracer-Controlled Miller for *every* worksize requirement. *Every* Keller Machine offers the same important advantages: fast, accurate reproduction of complex 3-dimensional shapes, extreme versatility and an overall ability to produce highest work quality economically. These advantages will also make Keller *your* first choice for a wide variety of die, mold and other hard-to-handle 2- and 3-dimensional milling jobs. Write now for complete information.

Pratt & Whitney Company, Incorporated, 12 Charter Oak Boulevard, West Hartford, Conn.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

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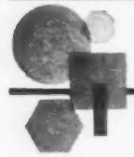

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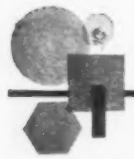

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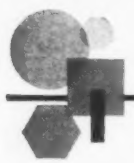

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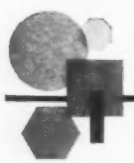

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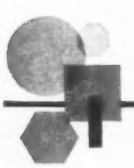

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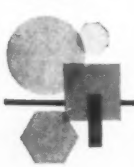

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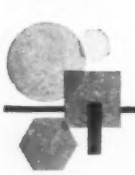

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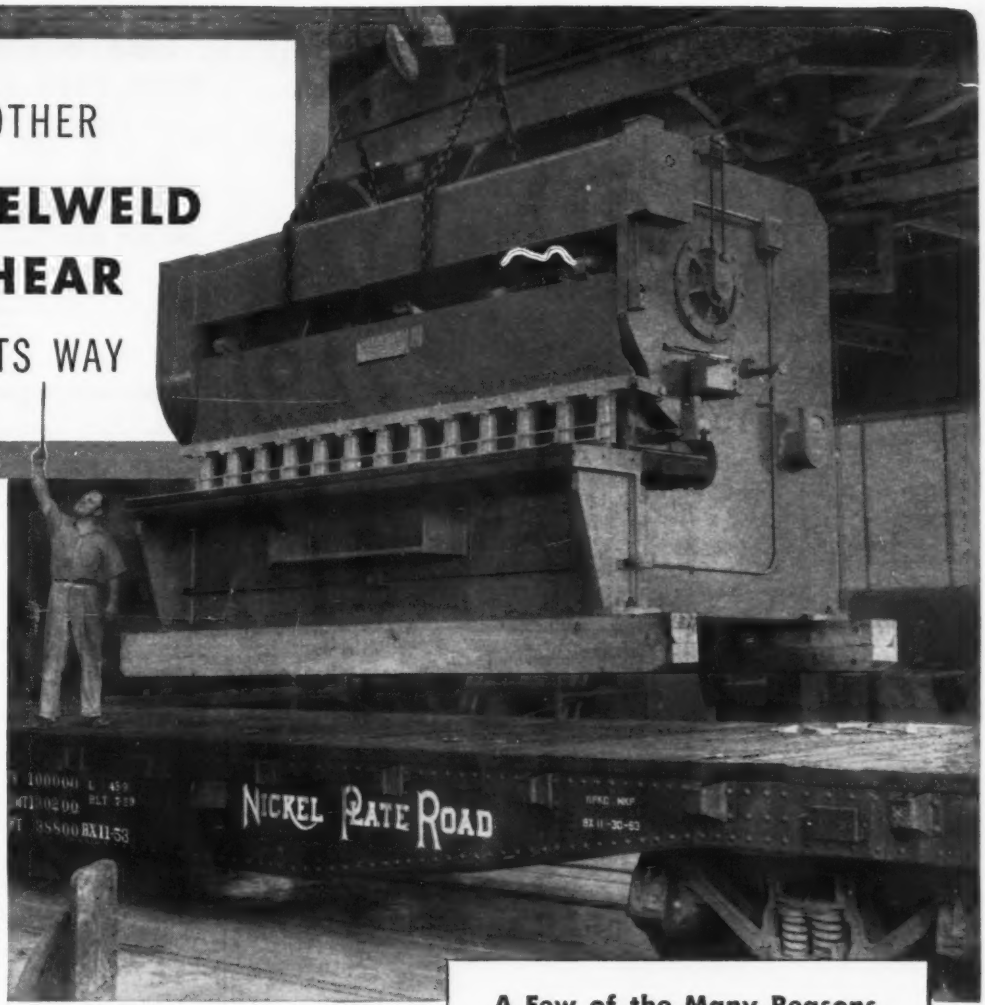

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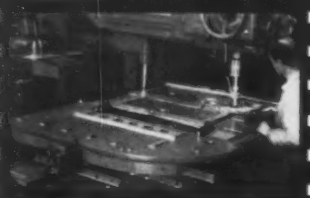

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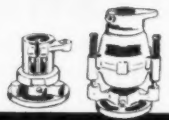

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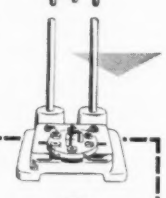

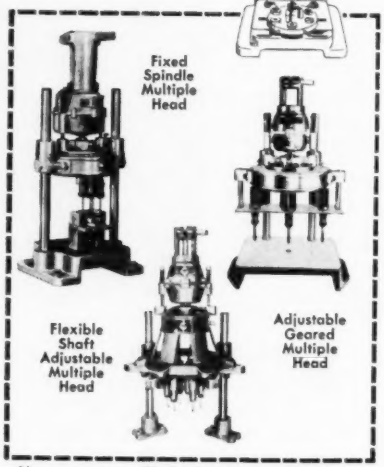

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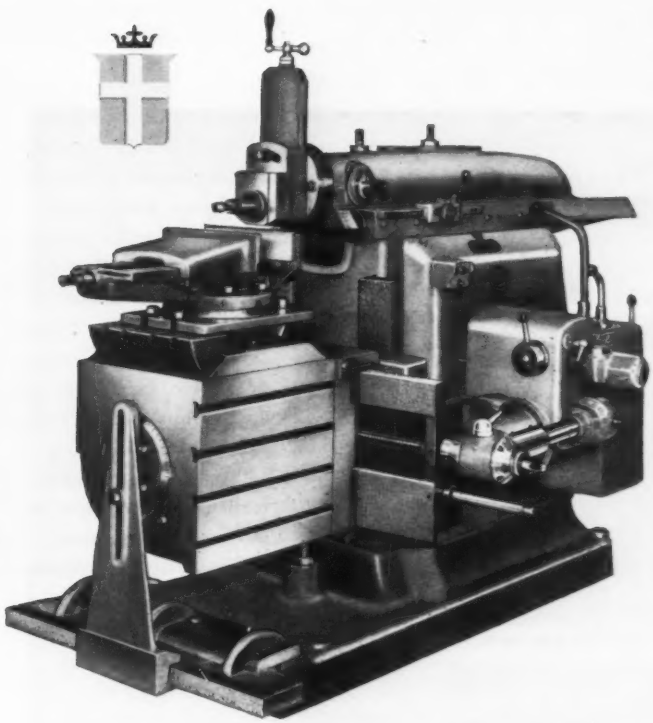

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Any material

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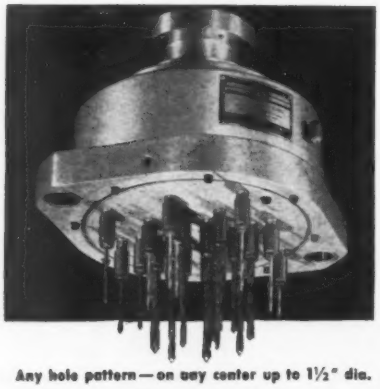
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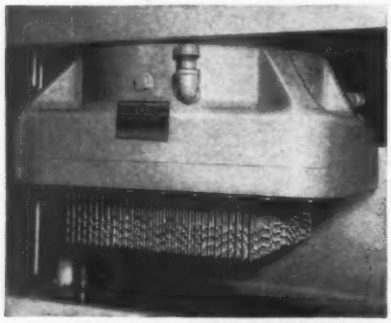
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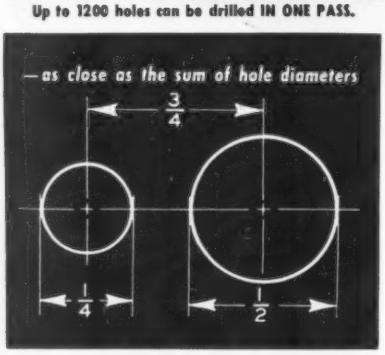

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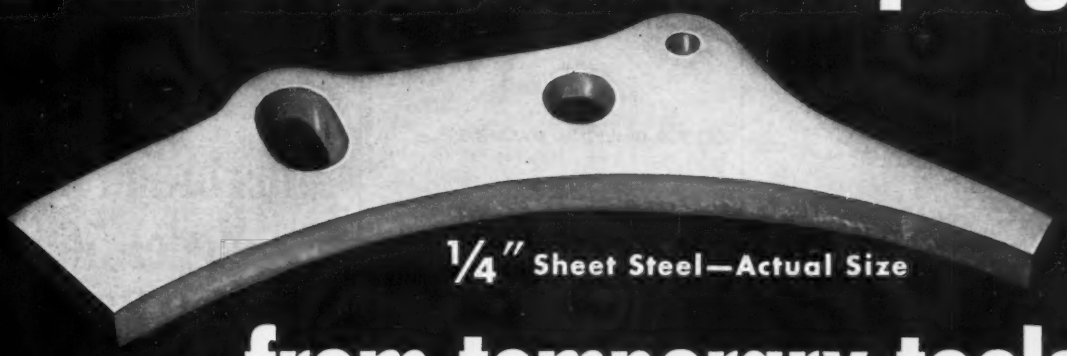

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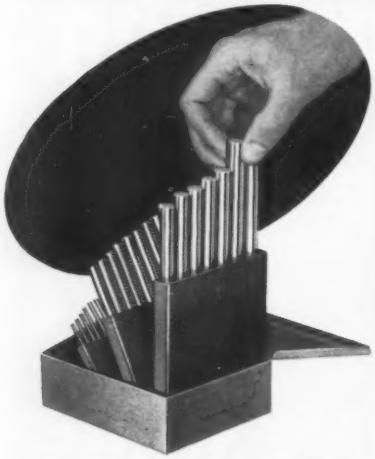

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Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
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Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

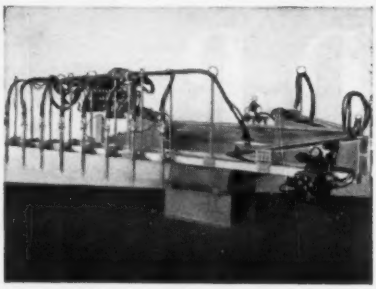
CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Coulter, James Mch. Co., 629 Railroad Ave., Bridgeport 5, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio

CHUCKING MACHINES, Multiple-Spindle Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing Mich.

(Continued on page 302)



this brand new Model 56 OXYGRAPH

has these exceptional advantages

Cuts a full 56" circle, and corresponding square and rectangular shapes

•

All-welded steel construction for lasting durability

•

Box-girder design of pantograph arms assures efficient operation even with maximum loading of operating bar

•

Reinforced operating bar provides for mounting of torch holders, torches, tracing devices and electrical control equipment

•

Centralized gas control of torches with electrical solenoid valves allows operator to turn on, light and shut off gases without leaving tracing table

•

A maximum of 8 torches can be used, with manual or motorized torch holders

•

A cutting-oxygen ease-on valve, supplied with the machine, is invaluable in making piercing starts

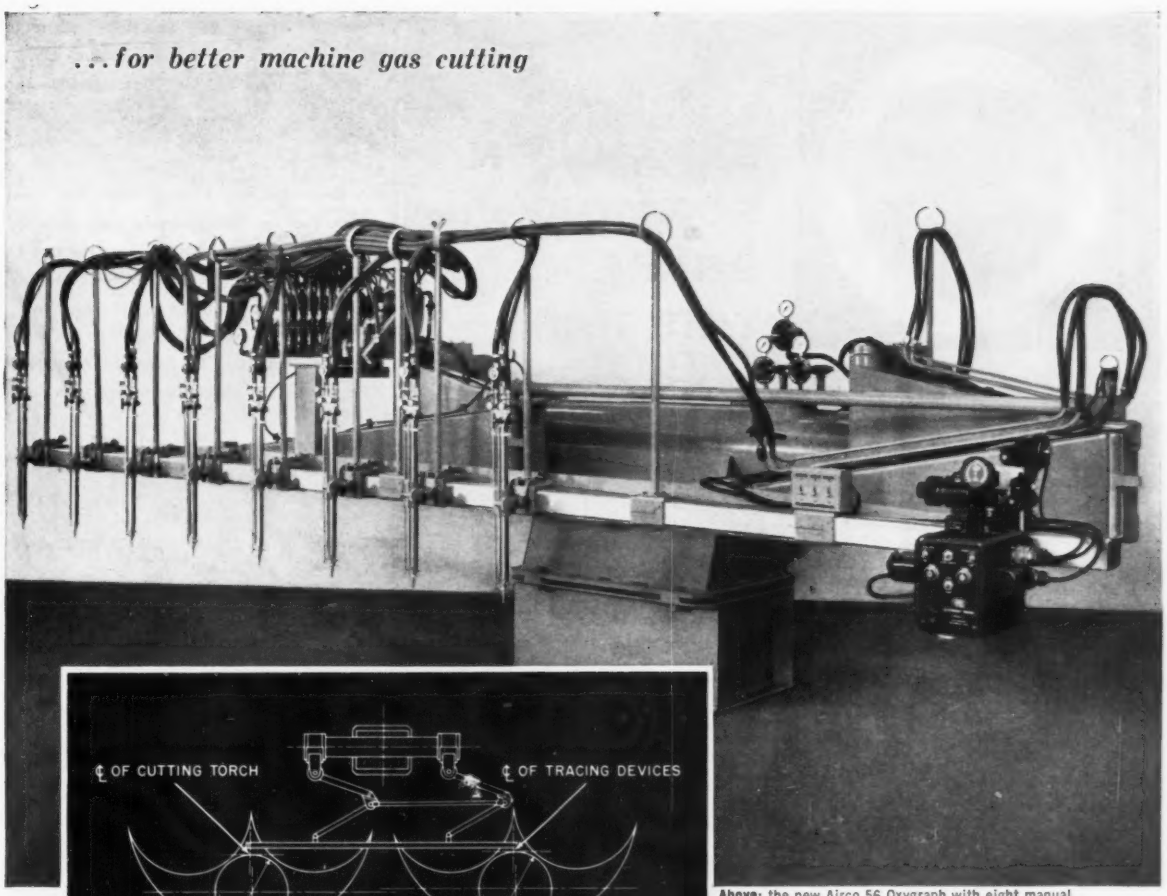
You'll find the new AIRCO 56 Oxygraph a substantial production help in metal shape cutting. For complete details

•

write direct to

AIRCO

...for better machine gas cutting



Above: the new Airco 56 Oxygraph with eight manual torches. All-welded construction provides unusual sturdiness and durability.

At left: drawing shows great versatility in patterns that can be cut with the new model 56.

NEW...Airco 56 Oxygraph

...for better machine gas cutting of larger work on production schedules

This newly developed Airco 56 Oxygraph meets the demand for a multi-torch oxy-acetylene shape cutting machine that will handle substantially large areas. It *cuts* a *full 56" circle*, and corresponding square and rectangular shapes. Rugged box girder design is used for the pantograph arms, holding vibration to a minimum. Tracer response is smooth and friction-free as a result of large diameter ball bearings in the pantograph hinges and operating bar assembly.

This newest of Airco Oxygraphs will cut an unlimited variety of shapes from steel plates, slabs, billets and forgings. Flexibility of design allows amplifying scope of machine to meet increased shop demands. Tracers are available in four types: electronic, manual, magnetic and spindle. This widened capacity of the new model 56 marks another step forward in welding and cutting progress. For detailed information on the New 56 Oxygraph, write direct to Airco.

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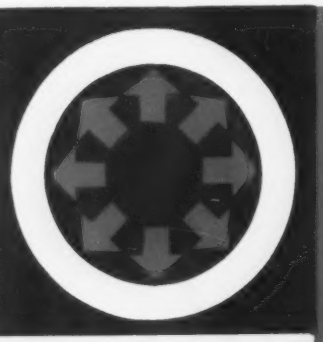
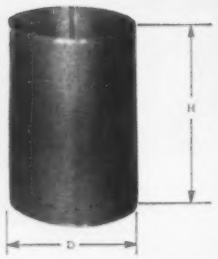
In Canada — Air Reduction Canada Limited

Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide, liquid-solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetates, alcohols, and other synthetic resins.

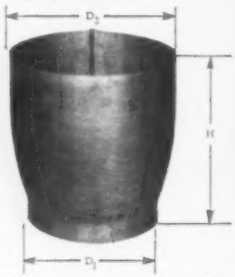


GROTNES EXPANSION FORMING SHAPED THIS PART—

how would YOU do it?



BEFORE EXPANDING—Deep Drawing Quality Steel 0.035" Thick is Coiled and Lap-Seam Welded to form the 9⅜" I.D., 12¾" High Cylinder Blank.



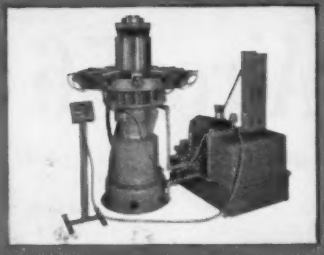
FIRST EXPANSION—Opens one end to 12½" dia.; Expands the other end to 10" dia.; reduces height to 11⅜"

SECOND EXPANSION—Forms the bead; opens the large end to 15" dia.; leaves the small end at 10" dia.; reduces height to 11¼"; reduces metal thickness to .031" at the large end.

After trimming the protrusion at the weld, the part is ready for subsequent operations. Success in expansion forming this part, as well as any other, depends on metal ductility and weld strength.

Expansion forming and sizing the connector illustrated results in smaller tooling investment, lower material cost, less scrap, fewer operations, higher production.

GROTNES MACHINE WORKS makes a complete line of mechanical and hydraulic expanders to form and size metal parts having a continuous cross-section (circular, oval, square, polygonal). Tolerances can be held within plus or minus 0.002" on a diameter. Grotnes expansion forming makes difficult jobs easier. Cut your production costs by the Grotnes expansion forming method. Write today.



16-H-320 Horizontal table hydraulic expander typical of the Grotnes line of Hydraulic Expanding Machines.

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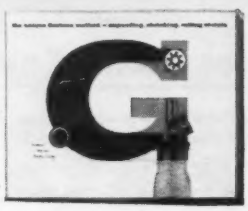

Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Collet

Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co. 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Wadell Equip. Co., Terminal Ave., Clark, N. J.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

For more information fill in page number on Inquiry Card, on page 257

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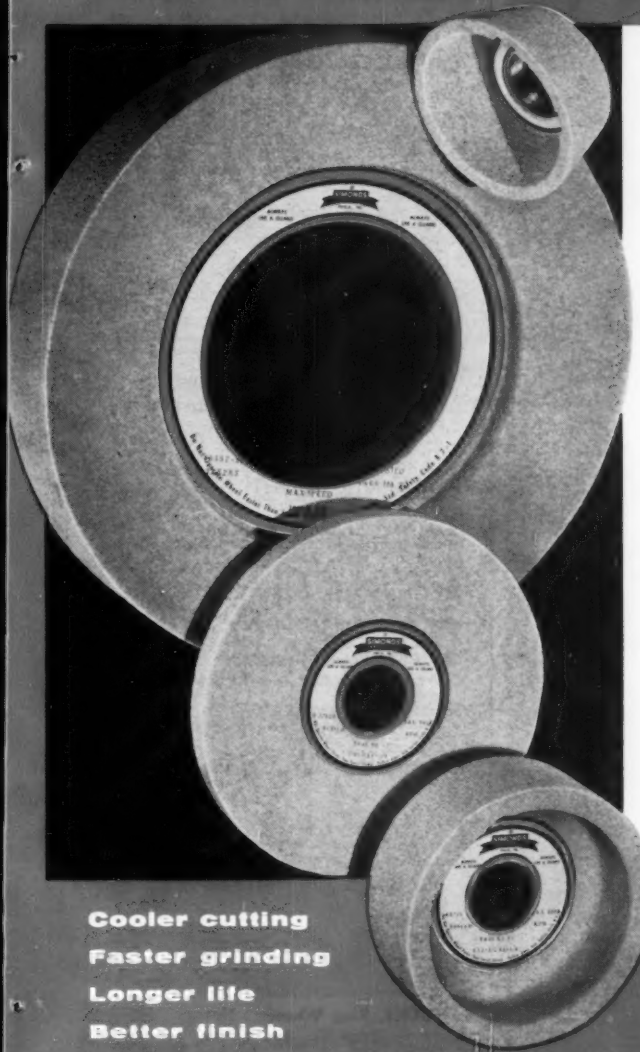
SIMONDS SA *Borolon*®

TRADE MARK

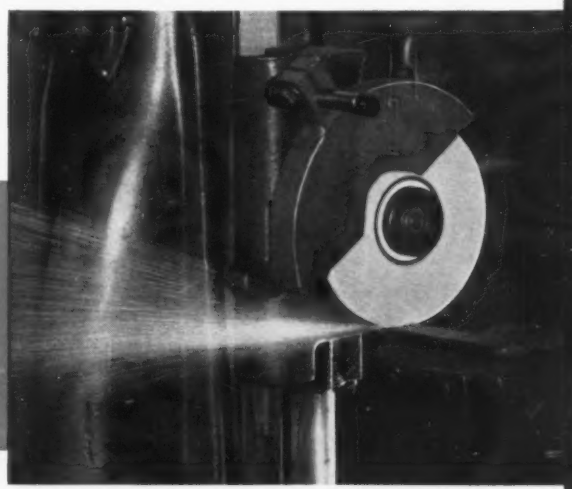
Grinding Wheels for Toolroom use



SA Borolon is a single crystal aluminum oxide abrasive possessing superior qualities over conventional white aluminum oxide abrasive. It is produced from a furnace charge consisting of a molten base with a soluble matrix which dissolves, leaving single, natural crystals of abrasive grain *without crushing*.

SA Borolon is tougher because it is free of the inner strains to which crushed abrasive is subjected. It penetrates deeper and cuts faster because each abrasive particle has more sharp, free-cutting edges. It cuts cooler because its resistance to dulling lessens frictional drag. Use these new wheels on your tool grinding jobs — and see the surprising difference in their grinding action. Write for illustrated Catalog Bulletin ESA-272.

Cooler cutting
Faster grinding
Longer life
Better finish



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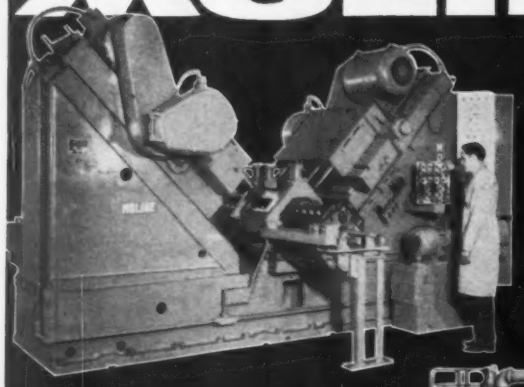
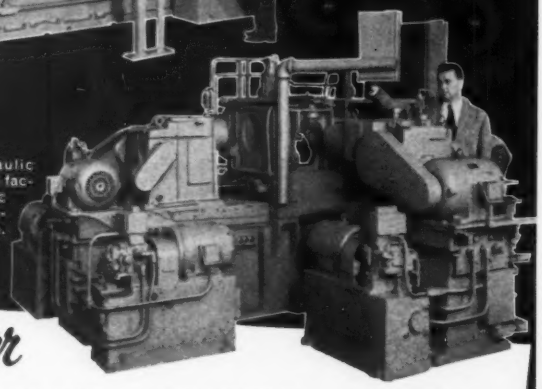


No. 13CB V-type cylinder boring unit is used either as an individual machine or as one of several automated units in a transfer line for boring automotive engine cylinders.



MR138 four-way, hydraulic feed, drilling, boring and facing machine with hydraulic clamping fixture for tractor main frame housings.

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- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
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- Special Multiple Operation Machine Tools

OVER 55 YEARS OF MACHINE TOOL ENGINEERING EXPERIENCE IS AT YOUR SERVICE. TELL US YOUR PARTICULAR PROBLEM

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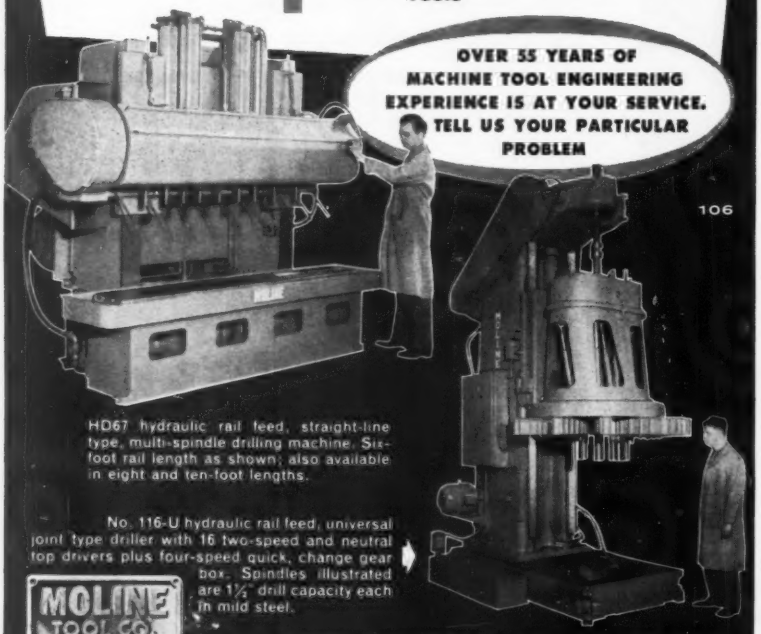

HD67 hydraulic rail feed, straight-line type, multi-spindle drilling machine. Six-foot rail length as shown; also available in eight and ten-foot lengths.

No. 116-U hydraulic rail feed, universal joint type driller with 16 two-speed and neutral top drivers plus four-speed quick change gear box. Spindles illustrated are 1⅛" drill capacity each in mild steel.

MOLINE TOOL CO. HOLE-HOGS MOLINE, ILLINOIS

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CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.

CHUCKS, Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Chicago Tool & Eng. Co., 8389 So. Chicago Ave., Chicago, Illinois (Milling Machine)
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Burg Tool Mfg. Co. Inc., Gardena, Calif.
Chicago Tool & Engrg. Co., 8389 So. Chicago Ave., Chicago, Ill.
Jacobs Mfg. Co., West Hartford 10, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

(Continued on page 306)

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And Parker-Kalon's wide range of types and sizes makes it possible

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"In a metal-to-plastic application such ▸ as the fastening of high-frequency speakers to formed plastic housings—P-K Type-Z thread-forming Screws go in right without cracking the plastic—stay put, even under high vibration."

◂ "In this important subassembly, appearance is important as well as dependable holding power. Here we use P-K Type-A Phillips Recessed Head Screws in a metal-to-metal application."

Whatever your product or application . . . ferrous or non-ferrous castings, sheet metal or structural steel, plywoods, asbestos compositions, pliable or brittle plastics . . . Parker-Kalon can furnish the proper fastener to speed assembly, reduce rejects, cut costs!

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fasteners

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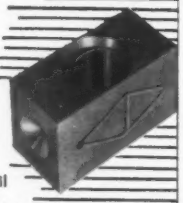
Special formulas developed for specific or unusual conditions. Will not cut or stick to the shaft under ordinary operating conditions. Carry on during temporary lubrication failures. Absolutely will not powder in severest service.



Highest quality machining to precisely controlled tolerances. Difficult oil grooving . . . smooth grooves, even around acute bends . . . no sharp edges or burrs . . . remarkably better lubrication. Also available rough cast.

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Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Universal Three-Jaw
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment Spacing Equipment

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Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Fawick Corp., Cleveland, Ohio
Minster Mch. Co., Minster, Ohio
Rockford Clutch Div., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

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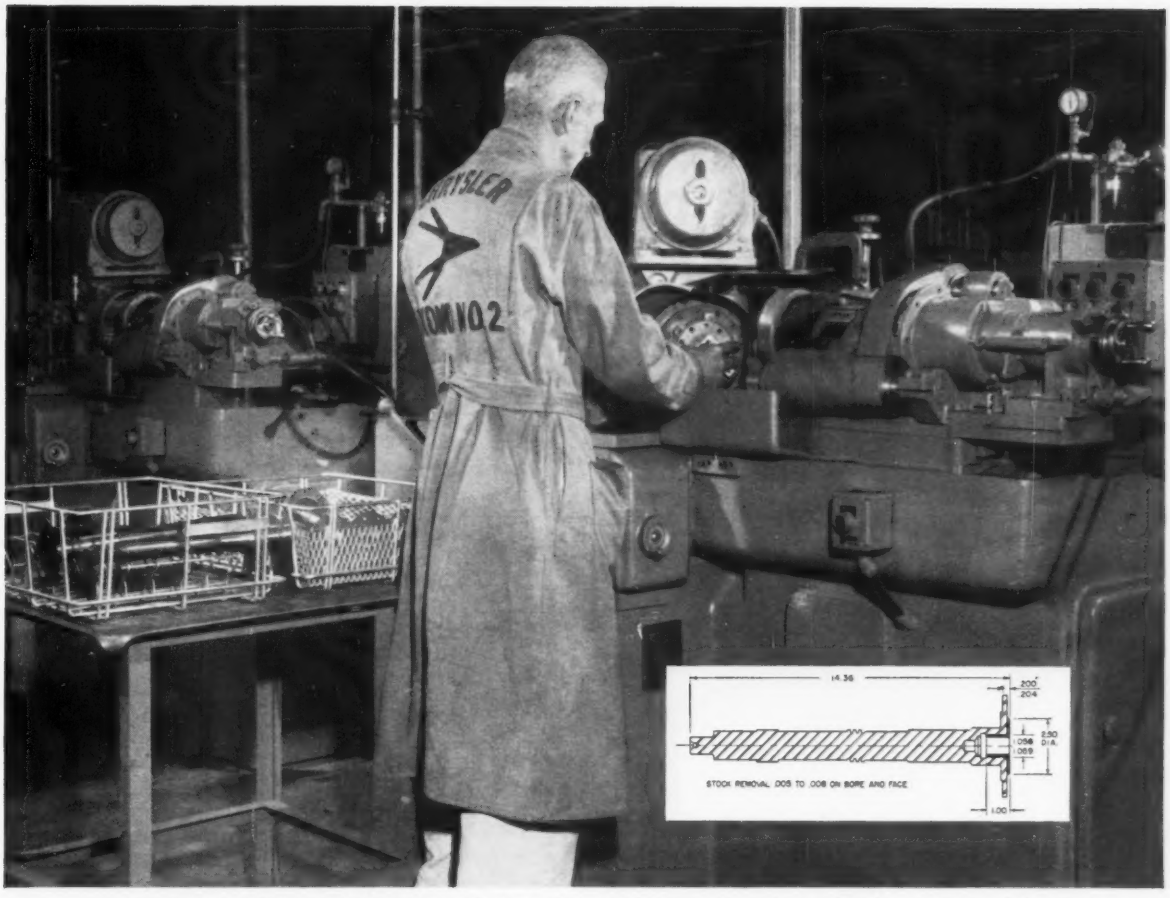
The 1957 Chrysler Imperial



A Bryant 2209-Y grinds transmission output shafts at Chrysler's new Kokomo, Indiana Torque Flite Automatic Transmission Plant.

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The automatic transmissions in 1957 Chryslers – and in all other Chrysler-built cars – are designed for long-lasting, trouble-free operation. Making them so, and doing it profitably, calls for mass-producing the precision machined parts, such as transmission output shafts.

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If you use gears in the product you make, we believe it will pay you, as it has others, to become acquainted with FAIRFIELD —the place where fine gears and differentials are produced to meet your specifications EFFICIENTLY, ECONOMICALLY! *Your inquiry will receive prompt attention.*

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MANUFACTURING CO.
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Fine Gears For FINE GEARS *Made to Order*

TRACTORS • CONSTRUCTION MACHINERY • ENGINES • BUSES • FARM IMPLEMENTS • MINING MACHINERY
DIESEL LOCOMOTIVES • MACHINE TOOLS • AIRPLANES • HEAVY DUTY TRUCKS • OIL FIELD EQUIPMENT

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
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Bliss, E. C., Co., 1375 Raff Rd. S. D., Canton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Michigan Drill Head Co., Van Dyke, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Van Keuren Co., Watertown, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co. Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

CONTROL SHAFTS—See Lead-screws & Splines, Ball Bearing

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F & John Co., Rockford, Ill.
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Heller Tool Co., Newcomerstown, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

COUNTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Mueller Brass Co., Port Huron, Mich.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Twin Disc Clutch Co., Racine, Wis.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

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a "one-man" team

The Finishing Specialist from Lowe Brothers is more than a seller of paints and finishes. He is a production specialist, well-versed in all processes and materials, and the latest in finishing techniques and equipment.

His "know-how," and ability to quickly analyze your problems, is capably supported by highly skilled research, development and production experts. He coordinates this know-how with your individual product and plant requirements and follows through to expedite preparation of the finish.

Call on him now and put this team to work immediately. The result will be the best finish for the job. Call or write The Lowe Brothers Company, 424 East Third Street, Dayton 2, Ohio.

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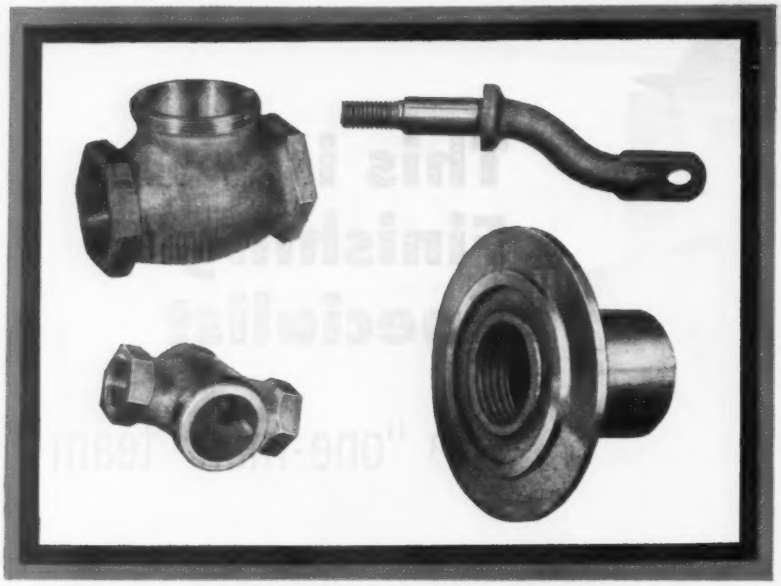
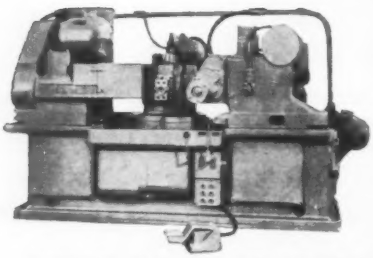
INDUSTRIAL FINISHES

. . . also Style-Tested paints for the home

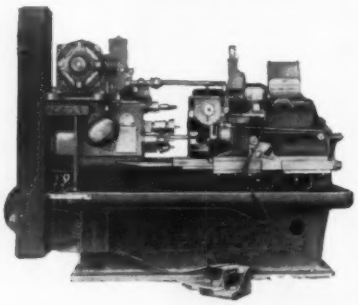


PLAN PRODUCTION of
PARTS LIKE THESE and MANY OTHERS . . .
for speed, convenience and economy
on GOSS & DeLEEUW
AUTOMATIC CHUCKERS



The "ONE-TWO-THREE" 7-Spindle TOOL ROTATING CHUCKING MACHINE

can complete in one operation as many as three ends of valve bodies, plumbing fittings, etc. eliminating secondary operations.



4-SPINDLE TOOL ROTATING CHUCKING MACHINES,

available in three sizes, combine various turning, boring, facing, threading, multiple drilling and tapping operations on a wide range of single-ended parts.

Send samples of your work for time estimates. Ask for illustrated literature.

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QUALITY PRODUCT-QUANTITY PRODUCTION

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

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Cleveland Crane & Engrg. Co., Wickliffe, Ohio

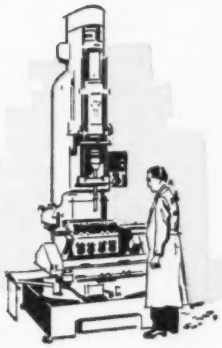
CUTTERS, Keyseating
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Goddard & Goddard Co., Detroit, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Haynes Stellite Co., Kokomo, Ind.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio
National Twist Drill & Tl. Co., Rochester, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS
Cincinnati Milling Products Div., Cincinnati, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., Penton Bldg., Cleveland 3, Ohio
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type
Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Grieder Industries, Inc., Bowling Green, Ohio
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.



"TRUKUT® completely eliminated gum and scum..."

A large manufacturer of mold bases had a problem with grinding coolants. The grinding oil mist was causing a heavy gummy scum to form on the machines and floors.

Sinclair Representative J. H. Schindler was called in to help solve the problem. Mr. Schindler reports: "I knew from actual experience that Sinclair TRUKUT EP Soluble Oil, Grade C, would give good wheel life and fine finishes without gum or scum. I submitted a 5-gallon sample for test. After changing to Sinclair's grinding coolant, the gum and scum were completely eliminated.

"Within a month, this plant swung over to TRUKUT in all grinders, as well as milling machines."

If *you* have a problem with grinding or cutting coolants, it will pay you to look into the advantages of Sinclair TRUKUT EP Soluble Oils. Contact your local Sinclair Representative, or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N.Y. *There's no obligation.*

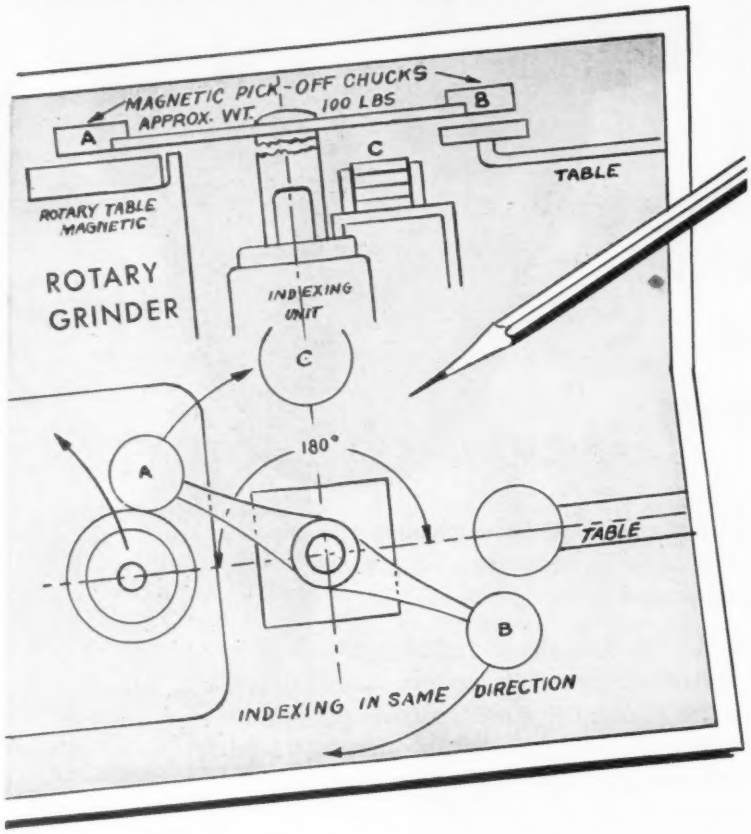
SINCLAIR

CUTTING OILS and COOLANTS

For more information fill in page number on Inquiry Card, on page 257

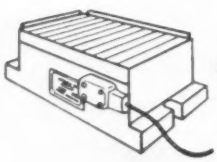
There may be a clue for you in this unusual application idea for

MAGNA-LOCK MAGNETIC CHUCKS...



Drawing shows Magna-Lock magnetic chucks incorporated in indexing mechanism designed to automatically load and unload parts from rotary surface grinder. The Magna-Lock chucks hold the work pieces during the indexing cycle. The extra holding power of Magna-Lock electro-magnetic chucks has solved many difficult problems of feeding and transferring parts as well as holding work for grinding, milling, turning.

If you have a problem, Magna-Lock has the engineering skill and experience to help you solve it. Write today, Dept. M-37.



Hanchett MAGNA-LOCK CORPORATION
BIG RAPIDS, MICHIGAN, U.S.A.
designers and makers of a complete line of magnetic chucks and devices.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Machine Co. Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio
Sheffield Corp., Box 893, Dayton 1, Ohio
Sunnen Products Co., 7910 Manchester, St. Louis 17, Mo.

DEMAGNETIZERS
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DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N. Y.

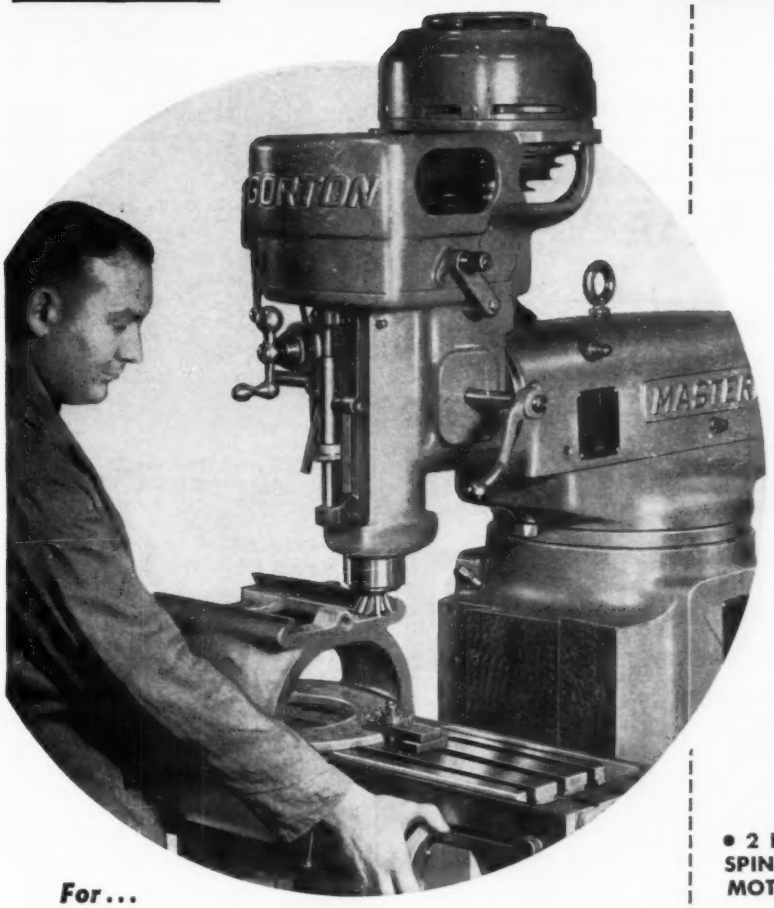
DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIEING MACHINES
Pratt & Whitney Co., Inc., West Hartford, Conn.

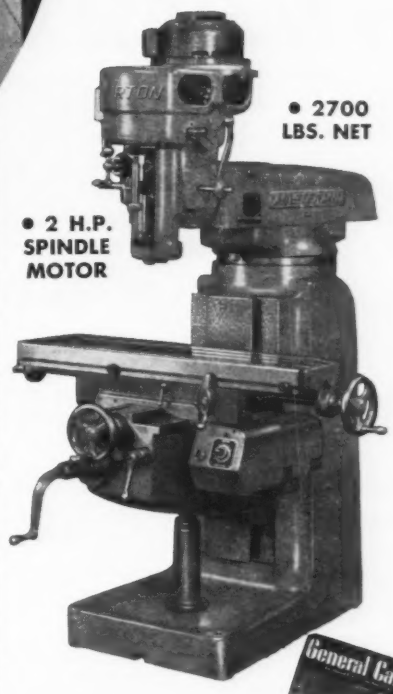
DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp. North Chicago, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wales-Strippit Co., No. Tonawanda, N. Y.

NEW Gorton Mastermil



- PRECISION SPINDLE; 10 SPEEDS, 80-5600 R.P.M. *STANDARD*
- DESIGNED AND BUILT TO PROVIDE SUSTAINED ACCURACY
- LONGITUDINAL FEED, 22 INCHES
- SADDLE LENGTH, 24 INCHES
- CROSS FEED, 10½ INCHES
- VERTICAL FEED OF KNEE, 15¼ INCHES
- SPINDLE FEED, 4 INCHES



- 2700 LBS. NET
- 2 H.P. SPINDLE MOTOR

For...

Milling, boring, duplicating in tool rooms, model shops, pattern shops, production lines, general machine shops, experimental laboratories, machine shops, schools — wherever high-speed vertical milling is done.

Also available...

Infinitely variable spindle feed from ¼ inch to 8 inches per minute.

Infinitely variable table feed (longitudinal) in 4 ranges: from ½ inch to 60 inches per minute.

Ask for special bulletin, No. 2699, on new Gorton Mastermil and for general catalog, 1303-1655, covering the entire Gorton line.

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DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.

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Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Eastern Mch. Screw Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

DIES, Wire Drawing

Vascoloy-Ramet Corp., North Chicago, Ill.

DISINTEGRATORS

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Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
DoAll Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAWING COMPOUNDS

Oakite Products, Inc., 26 Rector St., New York 6.

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

DRIFT KEYS

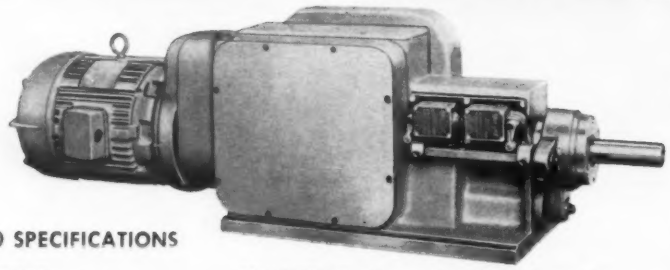
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

(Continued on page 316)

New! CAM FEED DRILL UNITS BY MILLHOLLAND



#4000 SPECIFICATIONS

Motor Horsepower ..... 3/4 HP-1200 RPM to 5 HP-1800 RPM
Thrust, maximum ..... 1800 lbs.
Length of stroke, maximum ... 6"
Spindle Speeds ... 95 to 4000 RPM
Stroke Cycle .... 1-1/2 seconds to 6 minutes
Capacity in Steel .... 1-1/2" Drill

Write for Bulletin M-4000 giving further details.

The Millholland cam feed drilling unit has a capacity of 5 HP and maximum stroke of 6". This unit employs the very efficient plate cam with pneumatic counterbalance that has been used for years in Millholland Units. The No. 4000 unit is completely enclosed and is lubricated by a micro-fog system which conveys oil from a container external to the unit to all bearing surfaces and gears.

Clutching and declutching of the feed mechanism are controlled electrically through a solenoid air valve mounted in the unit, which in turn operates an air cylinder mounted directly on the clutch. 30 P.S.I. air pressure is sufficient to provide instantaneous response of the feed clutches.

The roller-bearing cam roller is mounted in the spindle carrier and accurately translates the circular lead cut on the cam to a constant linear feed on the spindle carrier. The hardened cam is manufactured from tool steel, and spindle reduction gears are shaved.

A single tool may be used in the spindle, or a multiple head may be attached to the spindle carrier.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

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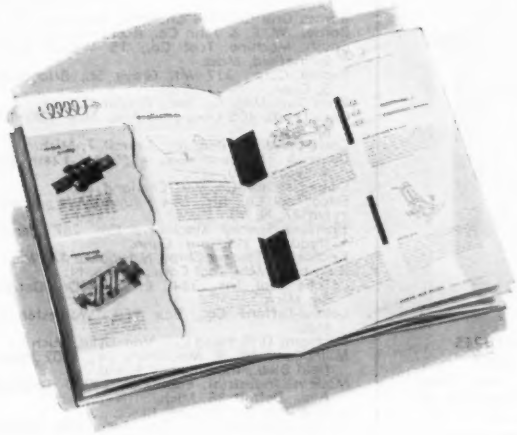
New 1957 Engineering Data Book from World's Largest Producers of Ball/Bearing Screws and Splines

36 pages crammed with time-, work-, and money-saving facts: Principles • Types • Basic Operations • Coupling Methods • Efficiency • Versatility • Advantages • Selection Factors • Design Data • Sample Problems, etc.



SAGINAW b/b SCREWS are *90%-98% efficient* (compared to 15%-20% efficiency of Acme screws). Require ⅔ LESS torque and power for same linear output—with consequent weight, space reductions. Function normally at −75° to +250° F. Two types: precision-ground or commercial rolled-thread. Have been built 1½ in. to 39½ ft. long.

SAGINAW b/b SPLINES have *40 times lower coefficient of friction* than sliding splines; transmit or restrain high torque loads far better; permit vital power, weight, space reductions. Have been designed 3 in. to 10 ft. long.

Saginaw ball bearing Screws & Splines

SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP., SAGINAW, MICH.

SEND FOR YOUR FREE COPY TODAY

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b/b Screw and Spline Operation
Dept. 6Y, Saginaw, Michigan

Please send 1957 engineering data book on Saginaw b/b Screws and Splines to:

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COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

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National Automatic Tool Co., Richmond, Ind.
National Twist & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 2400 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

DRILLING AND BORING UNITS, Self-contained

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Govro-Nelson Co., 1931 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Homestrand, Inc., Larchmont, N. Y.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Western Machine Tool Works, Holland, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Automatic

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 933 Harriet Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

(Continued on page 318)

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BUILT
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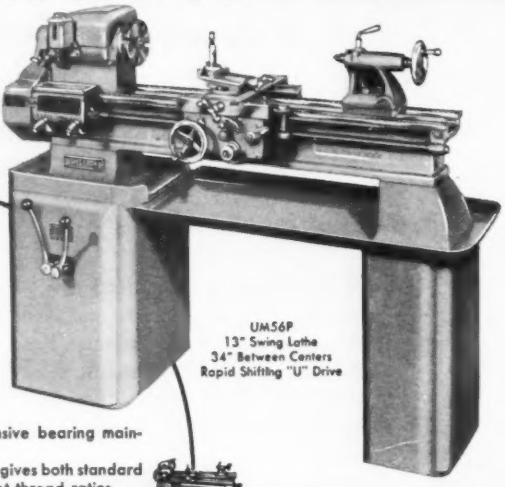
Sheldon Lathes are designed and built to do accurate lathe work rapidly and profitably. Moderate in price they have the collet, swing and power capacity to do most toolroom work.



UM56P
13" Swing Lathe
34" Between Centers
Rapid Shifting "U" Drive

Design Features:

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- Large Micrometer Dials—Make accurate operation easier.
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- More Power to Spindle—Efficient drives with bigger motors and double neoprene V-belts to spindle.

OPTIONAL FEATURES AT EXTRA COST include: Hardened ways, Long Tapered Key Drive Spindles, 4" D1 Camlock Spindles bed turrets, collet attachments, and other production and toolroom accessories. Lathes available with a choice of "Bench," "Cabinet" or "Pedestal" mountings.

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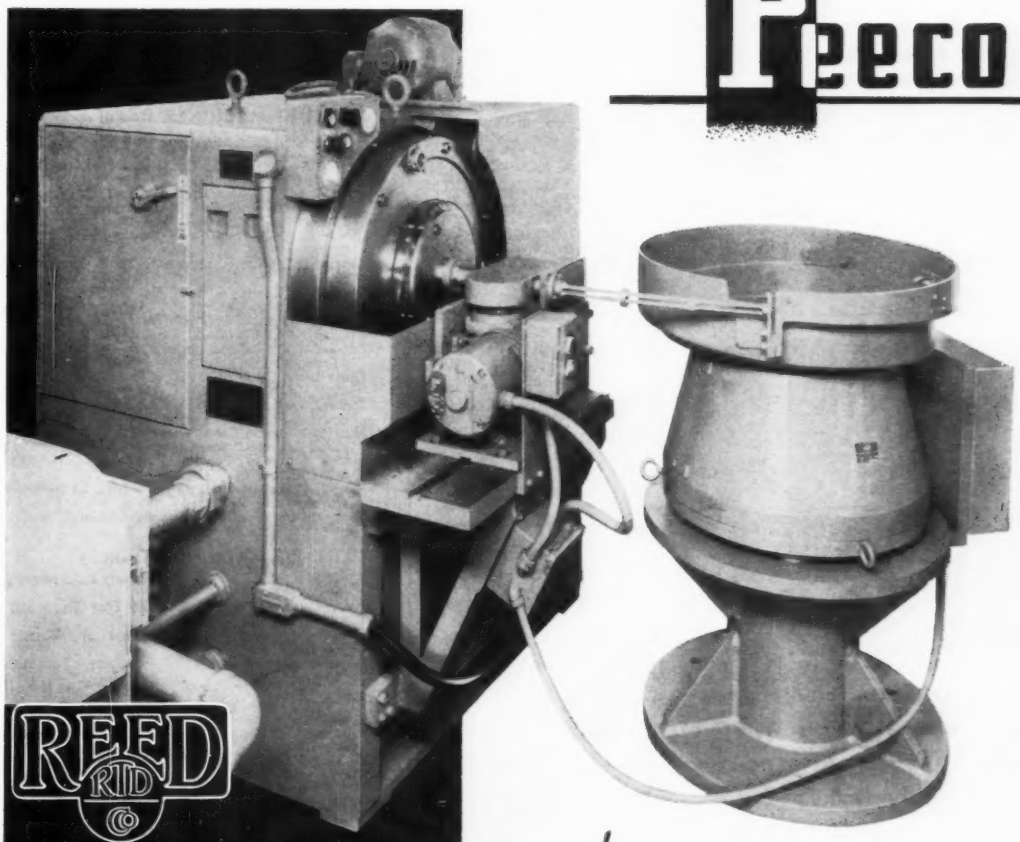
produces MORE with Peeco



REED ROLLED THREAD DIE CO.
production equipment *Now* includes
DEVELOPED Peeco FEEDERS

The PEECO Vibratory Parts Feeder (Model 25) pictured here is the feeding mechanism which supplies a continuous flow of blanks for the A23 Reed Thread Rolling Machine. Production rate of this machine for rolling high pressure stud threads varies from 70 inches (and up) per minute, depending upon the outside diameter of the blank and the number of threads per inch to be rolled.

Peeco

As a leader in the field of vibratory parts feeders PEECO is contributing its share towards the greater capacities being achieved by new production equipment. We are glad to include, among the companies in this field now being served by PEECO, the Reed Rolled Thread Die Co. of Holden, Massachusetts, specialists in thread and form rolling tools and equipment.

If you want to produce more, send for bulletin # 536 and ask for the name of the PEECO representative in your area.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Deep Hole

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Morris Machine Tool Co., Inc., 933 Harriet cinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., Box 989, Worcester, Mass.
Michigan Drill Head Co., Van Dyke, Mich.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, South Bend 22, Ind.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Radial

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
Levin & Son, Inc., Louis, 3610 So. Broadway, Los Angeles, Calif.
National Automatic Tool Co., Inc., S. 7th and N St., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., North Tonawanda, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div. Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

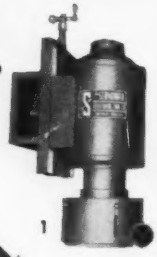
DRILLING MACHINES, Upright

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Avey Drilling Machine Co., 25 East Third St. Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.

(Continued on page 320)

STANDARD has a spindle for every purpose!

PRECISION MOTOR OR BELT-DRIVEN SPINDLES OR WORK HEADS



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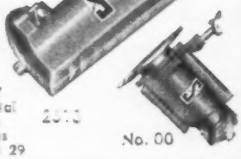

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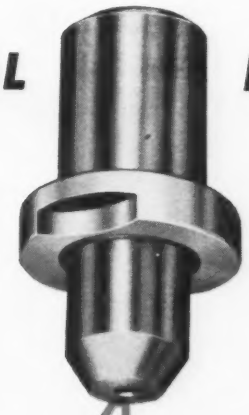
locate RIGHT ON THE NOSE!

WITH UNIVERSAL LOCATING PINS



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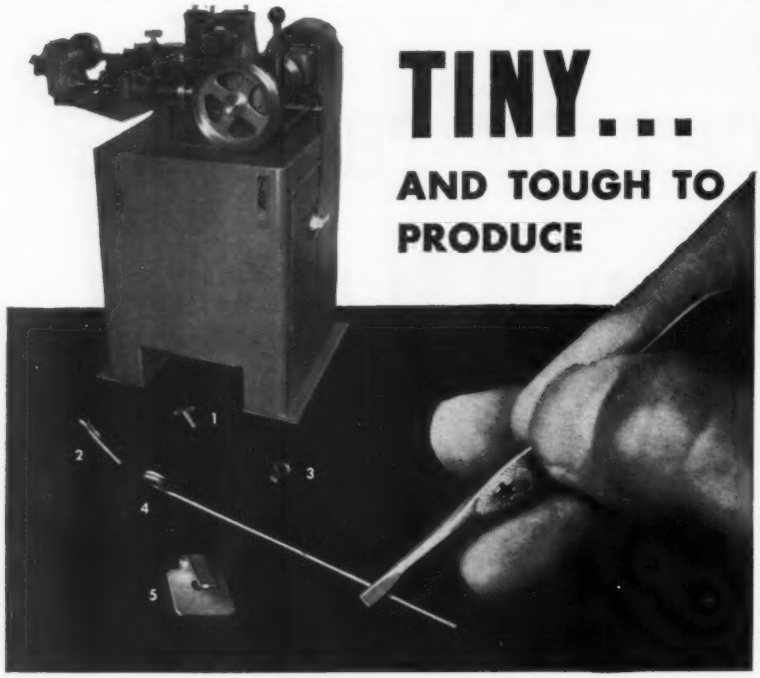

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Small wire and ribbon metal forms shown here in actual size are typical examples of modern precision production on a Nilson #00 4-Slide. Compact in size, this 4-Slide produces up to 375 pieces per minute in material not exceeding .040 dia. and 3" in blank length. Easy access to tooling, accurate feeding to within .003, and rugged construction assures years of precision forming.

1 Mercury Switch Part . . . .014" x .019" platinum wire, formed with tolerances within .001" on over-all length. Production rate, 175 per minute.

2 Electrical Contact . . . .0076" x .0030" wide phosphor bronze formed at a production rate of 200 per minute.

3 Swivel Part . . . .025" brass wire. Heading operation includes eye formed with tolerances within .008", shank within .003 tolerance. Production rate, 300 per minute.

4 Leadwire . . . .026" soft tinned copper wire formed at a rate of 140 per minute with two 7/64" diameter windings.

5 Contact Part . . . .010" x 3/8" wide phosphor bronze formed at 175 per minute.

Nilson makes a complete line of versatile 4-Slides . . . accommodating wire diameters up to ½", feed lengths up to 32", and ribbon metal up to 3" width . . . with press capacities ranging to 75 tons.

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Michigan Drill Head Co., Van Dyke, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., North Tonawanda, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Oil Hole, Oil Tube

Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
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DRILLS, Portable Pneumatic

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The Van Keuren Co. laps optical flats to an accuracy .000001", gage blocks to .000004", plug gages to .000010". Your job may not be this precise, but it's a safe bet that VK skills can save you money on lapping problems involving size, flatness, parallelism or fine surface finish. If that tough production part has at least one gage characteristic, ask for a quotation from VK.

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If you require lapped or polished surface finishes in the order of .5 to 5.0 RMS, or dimensional tolerances from .000001" to .0001", The Van Keuren Co. can probably help on the problem. The "rule of thumb," as suggested above, is "at least one gage characteristic."

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

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38th YEAR

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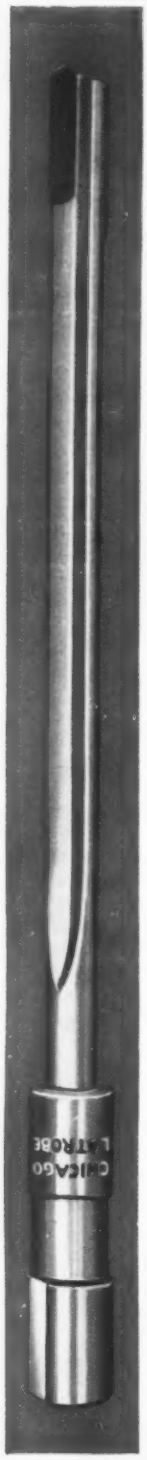

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., South Beloit, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., 34500 Grand River, Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel

Ace Drill Corp., Adrian, Mich.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, Carbide, Carbide-tipped

Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

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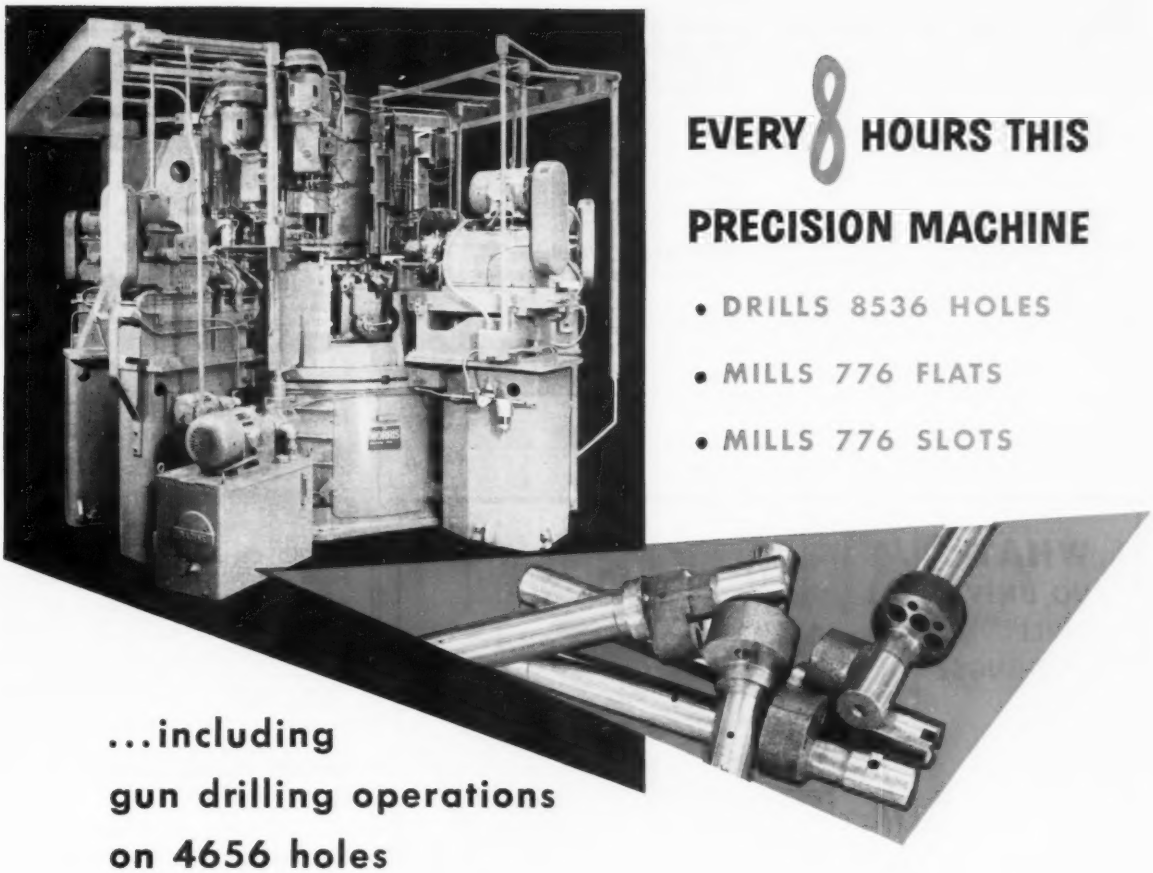

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...including gun drilling operations on 4656 holes

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Gorton, Geo., Mach., 1321 Racine St., Racine Wis.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

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Cross Co., 3250 Bellevue, Detroit 7, Mich.
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G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Michigan Drill Head Co., Van Dyke, Mich.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo N. Y.

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Perry Equipment & Eng. Co., Erie, Penna.

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

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DoALL Co., Des Plaines, Ill.
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Commercial Filters Corp., Lebanon, Ind.
DeLaval Separator Co., Poughkeepsie, N. Y.
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.

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Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

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Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Mueller Brass Co., Port Huron, Mich.

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Bridgeport Brass Co., Bridgeport, Conn.
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(Continued on page 326)

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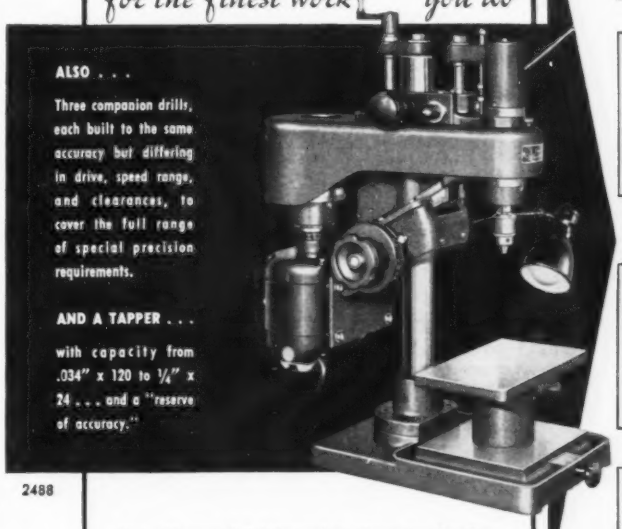

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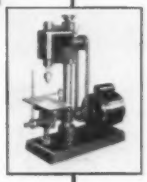

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Sheffield Corp., Box 893, Dayton 1, Ohio
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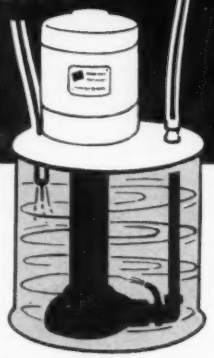

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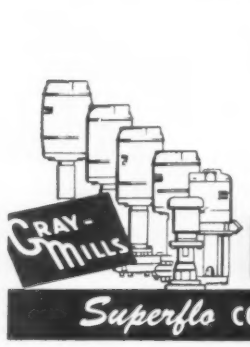

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Lees-Bradner Co., Cleveland, Ohio
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
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GEAR HOBBERS

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Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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ASSEMBLY AT BEST HEIGHT IN BEST LIGHT

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MORE SERVICE for LESS MONEY than ANY Other Unit of Equipment

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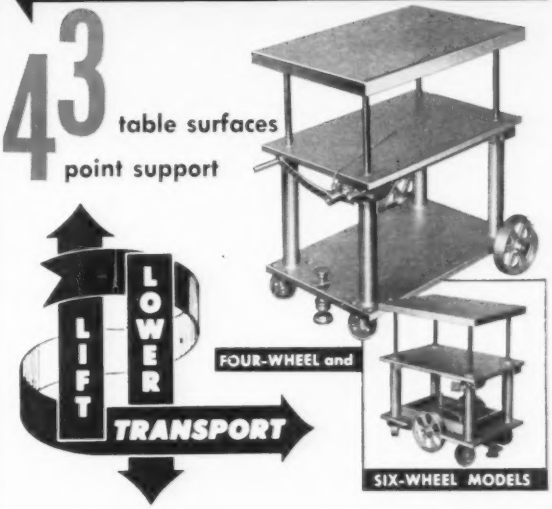
point support



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Kearny & Trecker Corp., Milwaukee 14, Wis.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric
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Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River Cincinnati 4, Ohio
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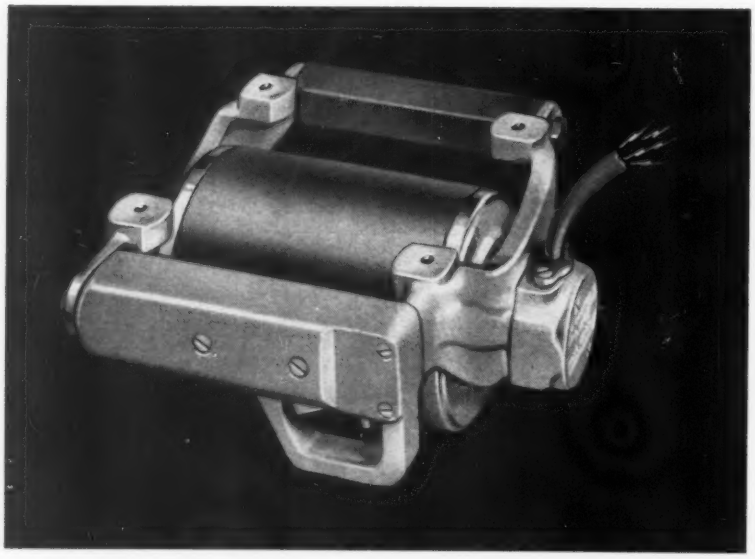

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Thor Power Tool Co., Aurora, Ill.

GRINDERS, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Wks., South Band 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., 175 N. State St., Aurora, Ill.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

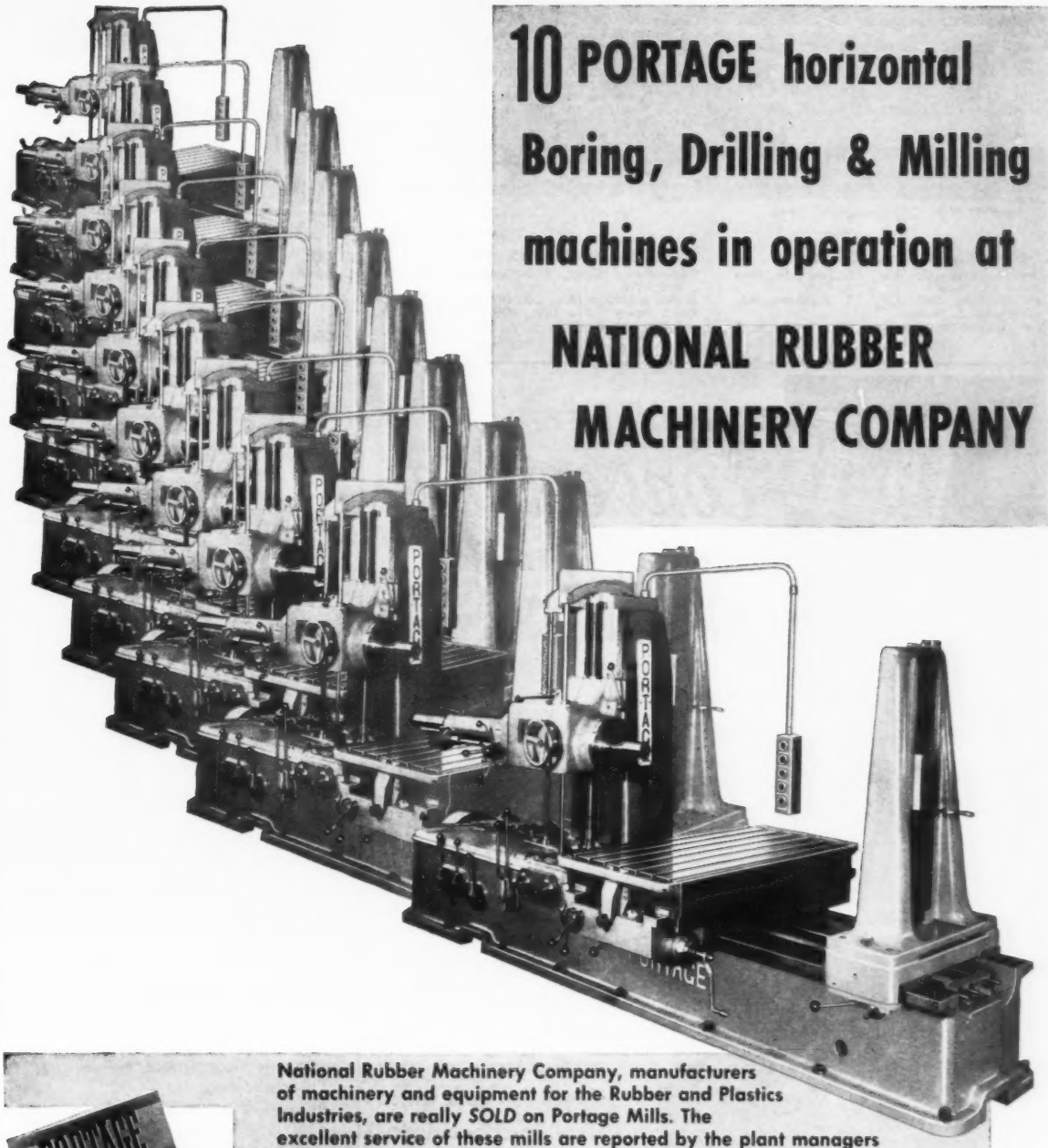
GRINDING MACHINES, Broach
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Detroit 13, Mich.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

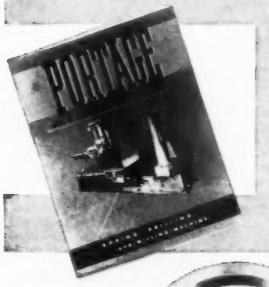
GRINDING MACHINES, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless
Bryant Chucking Grinder Co. Clinton St., Springfield, Vt.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio

(Continued on page 330)

10 PORTAGE horizontal Boring, Drilling & Milling machines in operation at NATIONAL RUBBER MACHINERY COMPANY





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Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

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Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6 Mass.
Van Norman Mch. Co., Springfield, Mass

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Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegan, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Co., 2640 Main St., Springfield 7 Mass.

GRINDING MACHINES, Disc

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
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Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Surface Reciprocating

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote—Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Homestrand, Inc., Larchmont, N. Y.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Surface Rotary

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(Continued on page 332)

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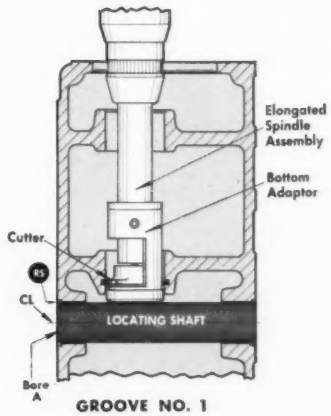
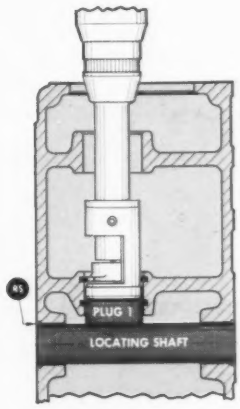
Waldes Truarc Grooving Tool pays for itself with big savings on one small run!

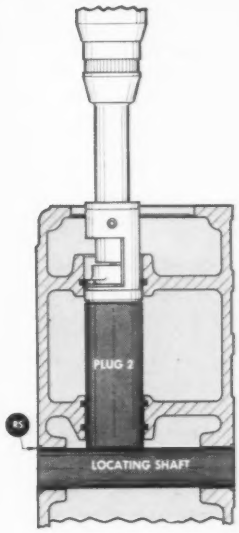
3 internal recesses cut in bores of 100 castings in 17.5 hours... including set-up time



GROOVE NO. 1



GROOVE NO. 2



GROOVE NO. 3

The job shown above called for three grooves located at prescribed distances from center-line CL of bore A. Depth and location tolerances: ±.0015".

Size and shape of the castings made nesting difficult for a boring bar operation. Exterior surfaces were unmachined, making alignment complicated. With two grooves over 7" from the housing's open end, boring bar chatter could have caused costly rejects.

To overcome these obstacles a Waldes Truarc Grooving Tool was equipped with an elongated spindle assembly and bottom adaptor. The tool was mounted in a drill press, the castings in a large vise. Grooves were then cut as follows:

Groove No. 1: A locating shaft was inserted into bore A as a reference surface and the tool piloted into the housing until the bottom adaptor banked on the shaft. The tool is designed so that the cutter rotates in a neutral position until additional downward pressure is applied. It then moves into cutting position until preset groove depth is reached, after which the tool idles. Release of pressure returns the cutter to neutral so that the tool may be withdrawn.

Groove No. 2: Plug 1 was inserted into the bore over the locating shaft and the tool again piloted into the bore. The groove was then cut the same way as Groove No. 1.

Groove No. 3: Plug 2 was substituted for the first plug and the cutting operation repeated.

All 300 grooves were held to prescribed tolerances. Set-up time: exactly 11 minutes. Operating time: 1050 minutes for 100 castings. Rejects: none!

No recessing problem is too tough for the amazingly versatile Waldes Truarc Grooving Tool. It's so simple even unskilled labor can use it accurately.

Write for a 20-page manual containing full information on Waldes Truarc Grooving Tool.

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MO39

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Gardner Machine Co., Beloit, Wis.
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National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

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Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegan, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Parker-Majestic, Inc., 147 Joseph Campau, Detroit, Mich.
Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

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DoAll Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Carborundum Co., Niagara Falls, N. Y.
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Cincinnati Milling Products Div., Cincinnati 9, Ohio
Cratex Manufacturing Co., 81 Natoma St., San Francisco, Calif.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Sterling Grinding Wheel Co., Tiffin, Ohio

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Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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HAMMERS, Portable Electric

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Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
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(Continued on page 334)

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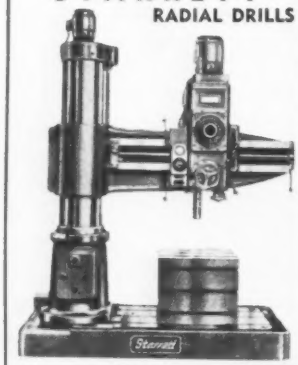

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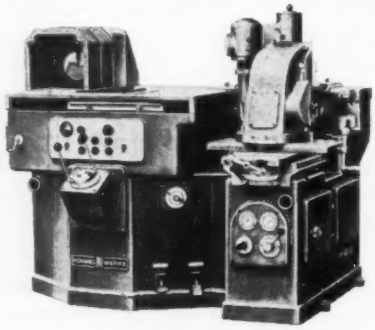

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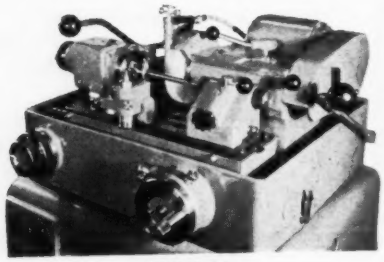

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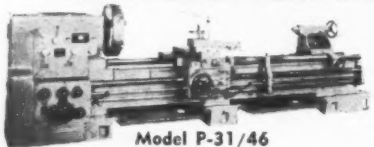

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Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
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National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Star Cutter Co., 34500 Grand River, Farmington, Mich.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Illinois

HOISTS, Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y

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Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

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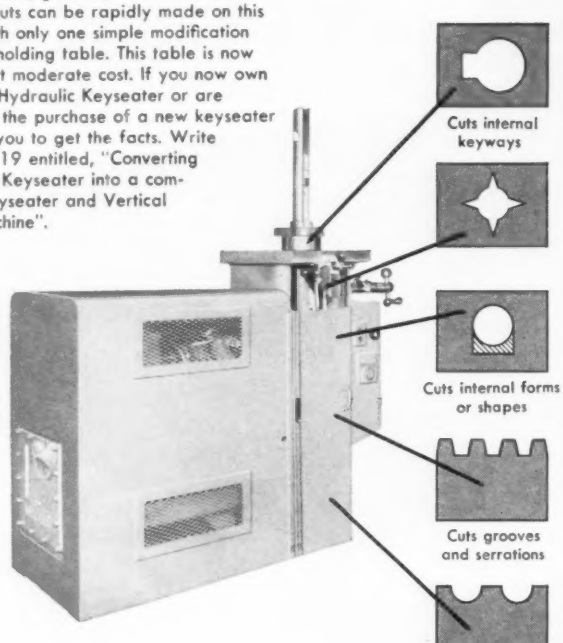

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Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
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Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
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Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
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Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch., 3640 Main St., Springfield 7, Mass.
Wadell Equip. Co., Clark, N. J.
Western Machine Tool Works, Holland, Mich.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
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Starrett L. S., Co., Athol, Mass.

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National Automatic Tool Co., S. 7th-N. Sts., Richmond, Ind.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S. Co., Athol, Mass.

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General Electric Co., Schenectady, N. Y.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp, P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Starrett, The L. S., Co., Athol, Mass.

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Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio

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Curtiss-Wright Corp., Caldwell, N. J.

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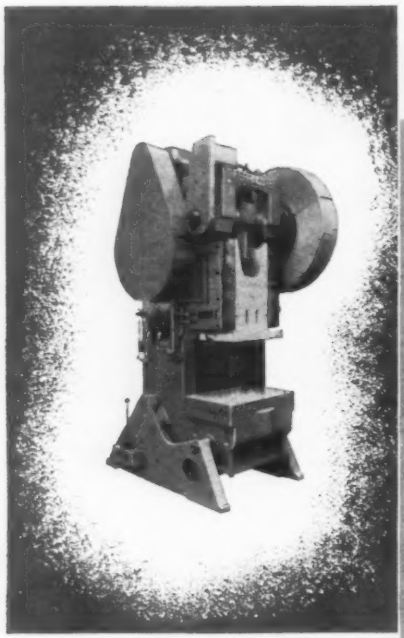
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St. Milwaukee 4, Wis.
Watson-Stillman Co., Roselle, N. J.



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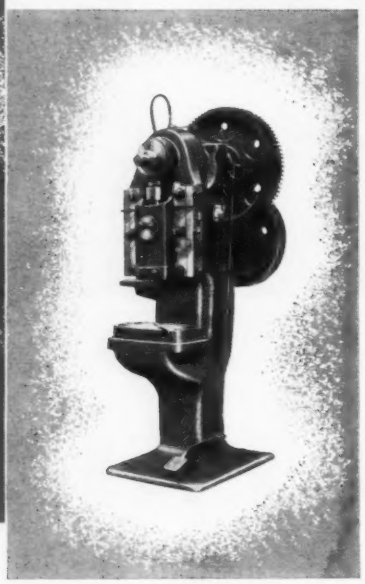

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Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
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Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

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Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co. 3055 Colerain Ave., Cincinnati 25, Ohio
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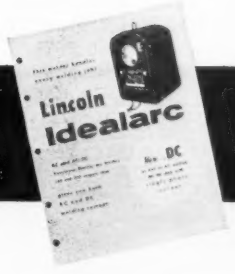

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Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
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Sidney Machine Tool Co., Sidney, Ohio
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Hydra-Feed Mch. Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
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Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
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Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
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Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co. 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebal Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
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South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
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Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co. 3055 Colerain Ave., Cincinnati 25, Ohio
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(Continued on page 342)

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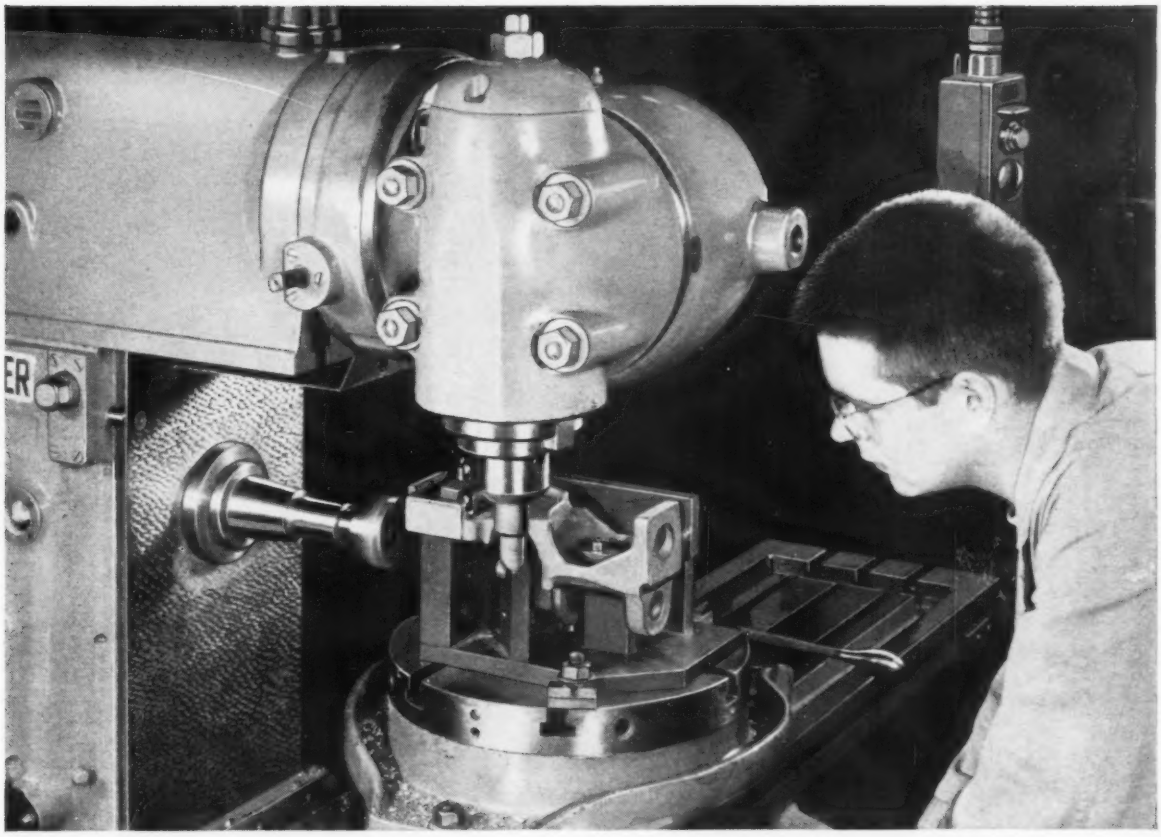

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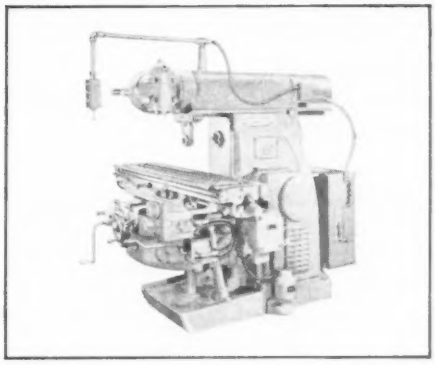
Multiple setups and excessive handling eliminated



10hp No. 3 Model CH, Plain style Ram Head milling machine with Mono-Lever and Automatic Cycle Table Control and Type U Universal Head.

Kearney & Trecker Ram Head Milling Machine completes seven operations without removing workpiece

Kearney & Trecker's new line of Ram Head milling machines combines a conventional horizontal spindle and a self-contained motorized sliding ram. As a result, horizontal and vertical spindles can be run separately and simultaneously.

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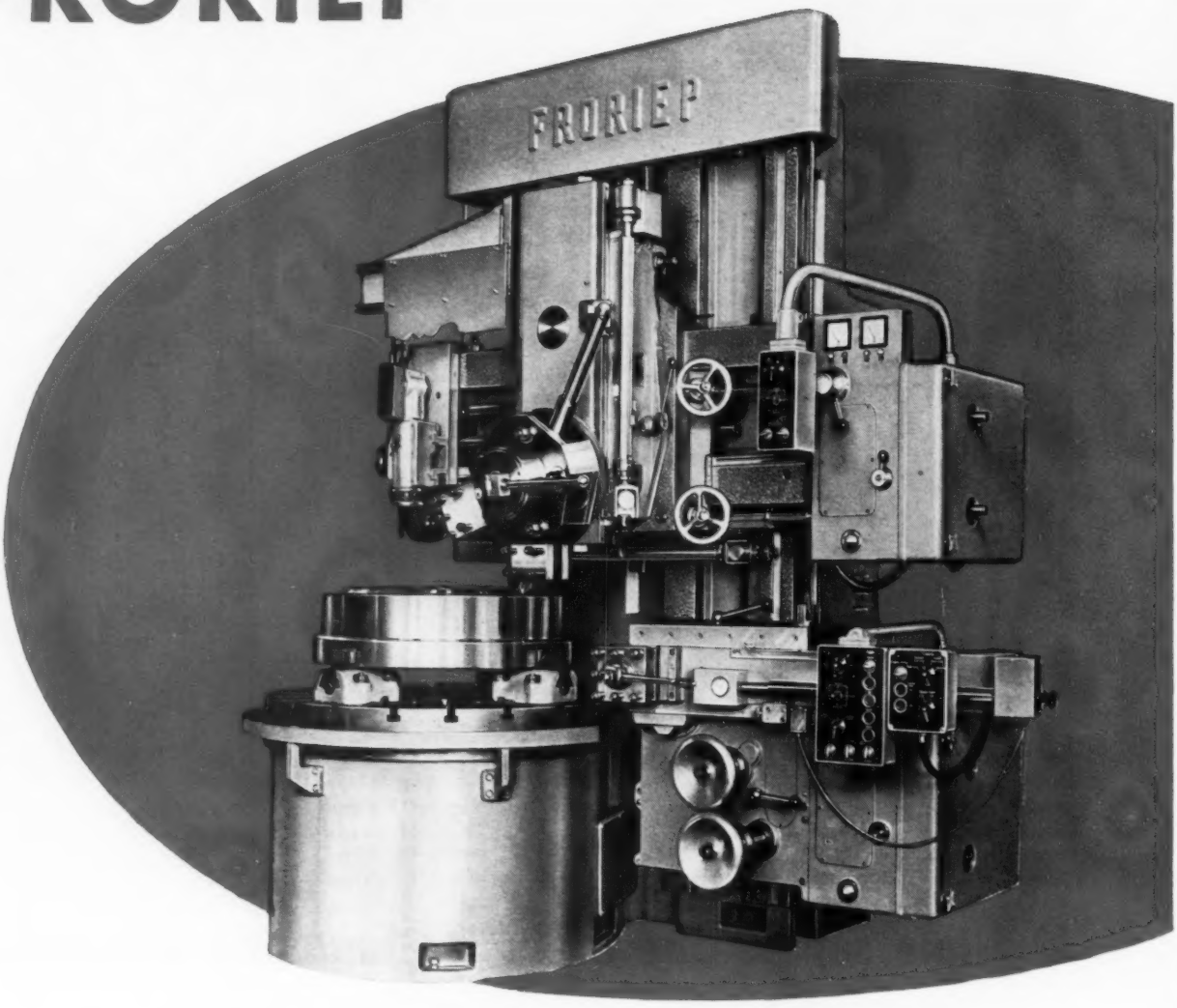

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By the use of tripping devices, diameters and depths can be repeated within set limits. Only finest adjustments need be made by hand. Feeds may be pre-selected.

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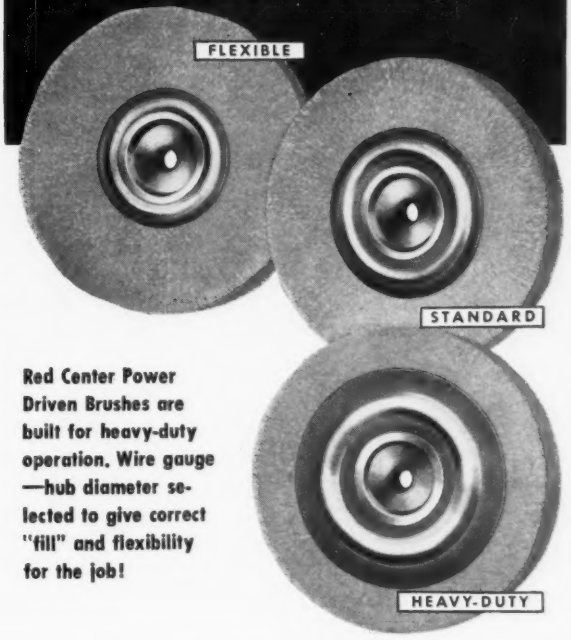
New Pittsburgh Red Center construction assures faster, better, easier brushing!



Red Center Power Driven Brushes are built for heavy-duty operation. Wire gauge—hub diameter selected to give correct "fill" and flexibility for the job!

Here's how Red Center Brushes work

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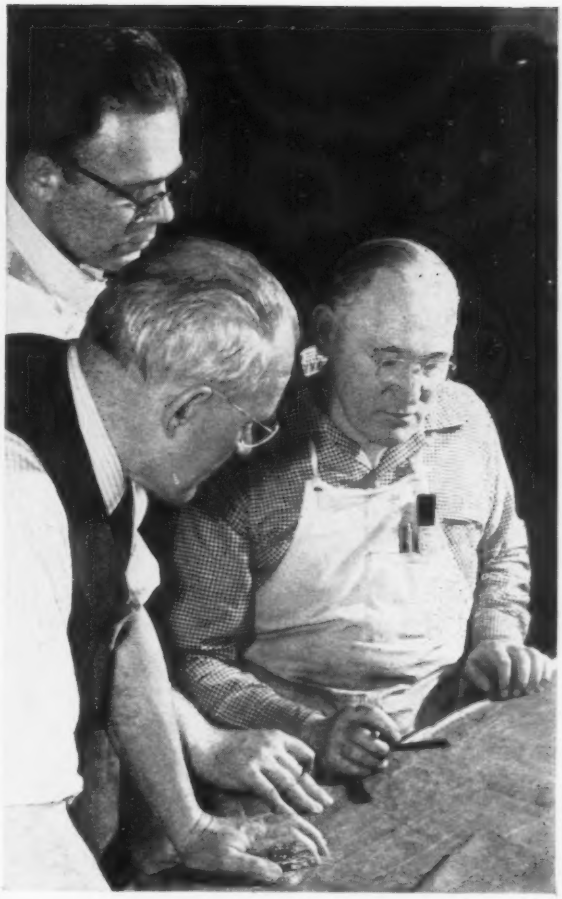

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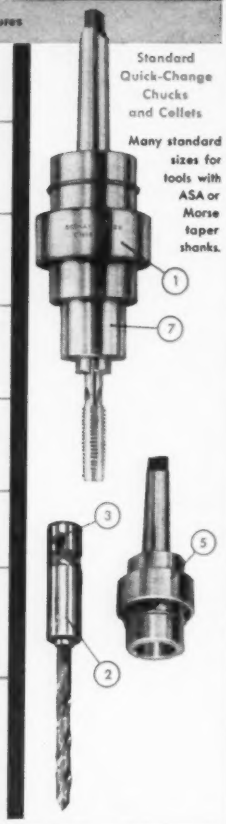
ASSURE GREATER OVER-ALL ECONOMY FROM YOUR MACHINES AND CUTTING TOOLS

These benefits	..for these reasons	...result from these PREMIUM features
INCREASE PRODUCTION	Change tools fast without stopping the machine.	1. Operator merely lifts locking ring, without stopping machine, and the collet with cutting tool drops out.
		2. Operator inserts replacement collet in one easy motion. Ring falls into place by gravity, and machine is ready for next operation.
	Faster, easier ejection of cutting tools from collet.	3. Exclusive keyhole-type drift slot permits ejection of tools by a simple twist of the wrist, using "Scully-Drift" or cam-type tool ejector.
REDUCE CAPITAL AND OPERATING COSTS	Minimize investment in special machinery.	4. Give multiple-spindle range to single-spindle machines used for sequence operations like drilling, counterboring, reaming, and tapping.
	Eliminate rejects.	5. Locking ring holds collet firmly and securely in chuck, providing a positive drive to the two balls which are the driving mechanism.
	Reduce maintenance and replacement costs.	6. Chucks are heat-treated and ground to prevent distortion and "nicking."
ASSURE SAFE OPERATING CONDITIONS	Eliminate safety hazards.	7. No ears or sharp edges on locking ring, and ample projection of collet, eliminate possible injury to operator when changing tools in motion.



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"Precision Holding" for holding precision

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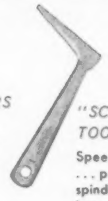
Take shock and abuse of heavy loads turning at high speeds.



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Offset splined section gives positive drive in drill flutes and protects cutting edges.

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Make control of drill depth simpler, more accurate. Sleeve snaps out for fast tool change.

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LATHES, Spinning

Cincinnati Milling & Grinding Mchs., Inc., 4701 Marburg Ave., Cincinnati 19, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgewater 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Nat'l Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks. South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

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Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.

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South Bend Lathe Wks. South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

LIGHTING FIXTURES, Machine

Sun-Lite Mfg. Co., 2555 Bellevue Ave., Detroit 7, Mich.

LIGHTS, Indicator

Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.
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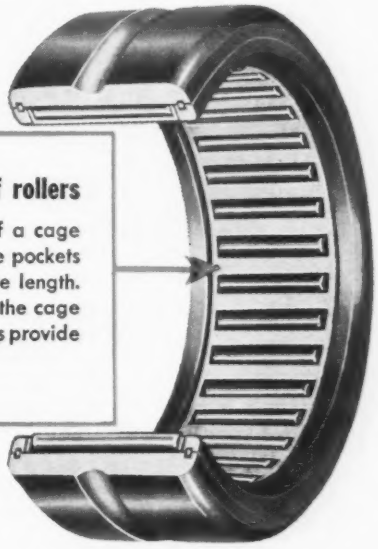
LIMIT SWITCHES—See Switches, Limit

ORANGE *Cage Type* NEEDLE BEARINGS

reduce friction to a minimum



HERE'S THE REASON:

Cage assures permanent alignment of rollers

Each needle roller is retained in pockets of a cage made of anti-friction, non-ferrous metal. These pockets guide and align the rollers along their entire length. The cage does not wear on the rollers, since the cage land rides on the outer race. Square end rollers provide maximum effective roller length.

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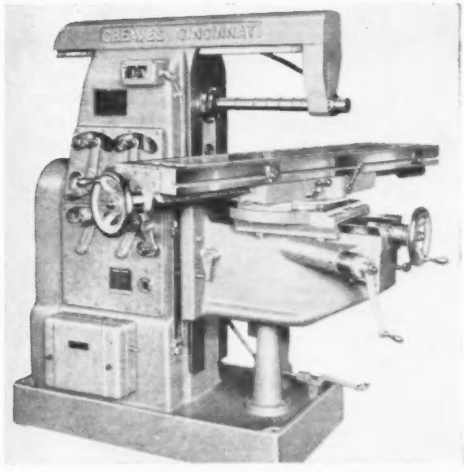
because

The Rollers Roll evenly — never Skew or Slide



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- **Less affected by misaligned mountings or uneven loading.**
- **Successful on relatively high speed applications.**

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• Write for Engineering Manual M-56, giving construction, capacities, dimensions, etc.

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Needle Bearings — Staggered Roller Bearings
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Cam Followers

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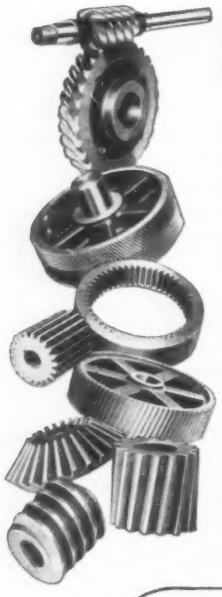
New H&S Gear Catalog



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Standard Oil Co. (Indiana) 910 S. Michigan, Chicago, Ill.
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Miles Mchry Co., 2025 E. Genessee Ave., Saginaw, Mich.
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Van Keuren Co., Watertown 72, Mass.
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Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, L. S., Co., Athol Mass.

MANDRELS—See Arbors and Mandrels

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Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.
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Gorton Mch. Co., 1321 Racine St., Racine, Wis.

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Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

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Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
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DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
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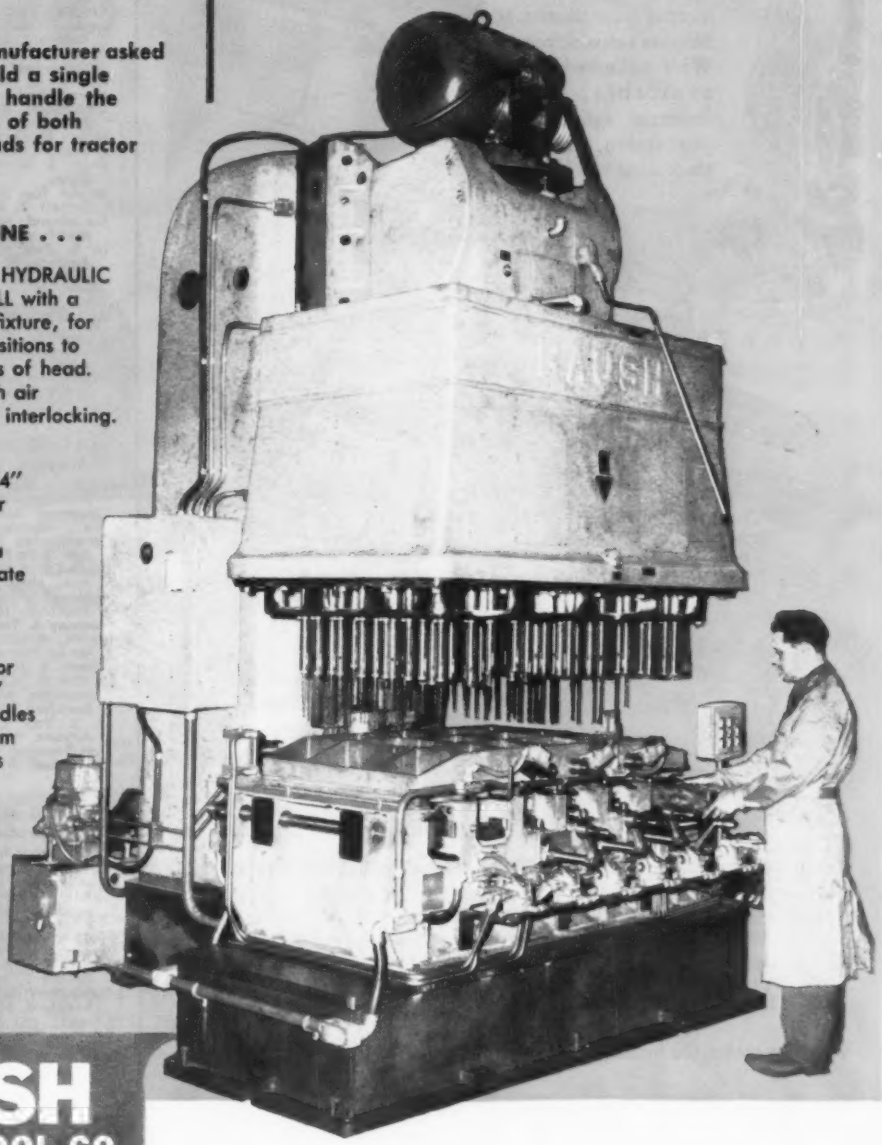
Machine has a 28" x 54" rectangular fixed center head with a 2-speed geared yoke and has a master-bored cluster plate for 80 holes, furnished with 80 slip-sleeve adjustable joint driven spindles. By removing or inserting the ¼" to ⅝" tools in the proper spindles a quick changeover from 4 to 6 cylinder heads is made. Spindles are driven by a 30 H.P., 1800 RPM motor and hydraulic pump is driven by a 5 H.P., 1800 RPM motor.



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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Donley Products, Inc., 1106 Avon Ave., Cleveland 5, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div. 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp. Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., Yonkers, N. Y.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Motch & Merryweather Machinery Co., Perkon Bldg., Cleveland, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morris, Robert E. Co., 76 Mamaroneck Ave., White Plains, N. Y.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

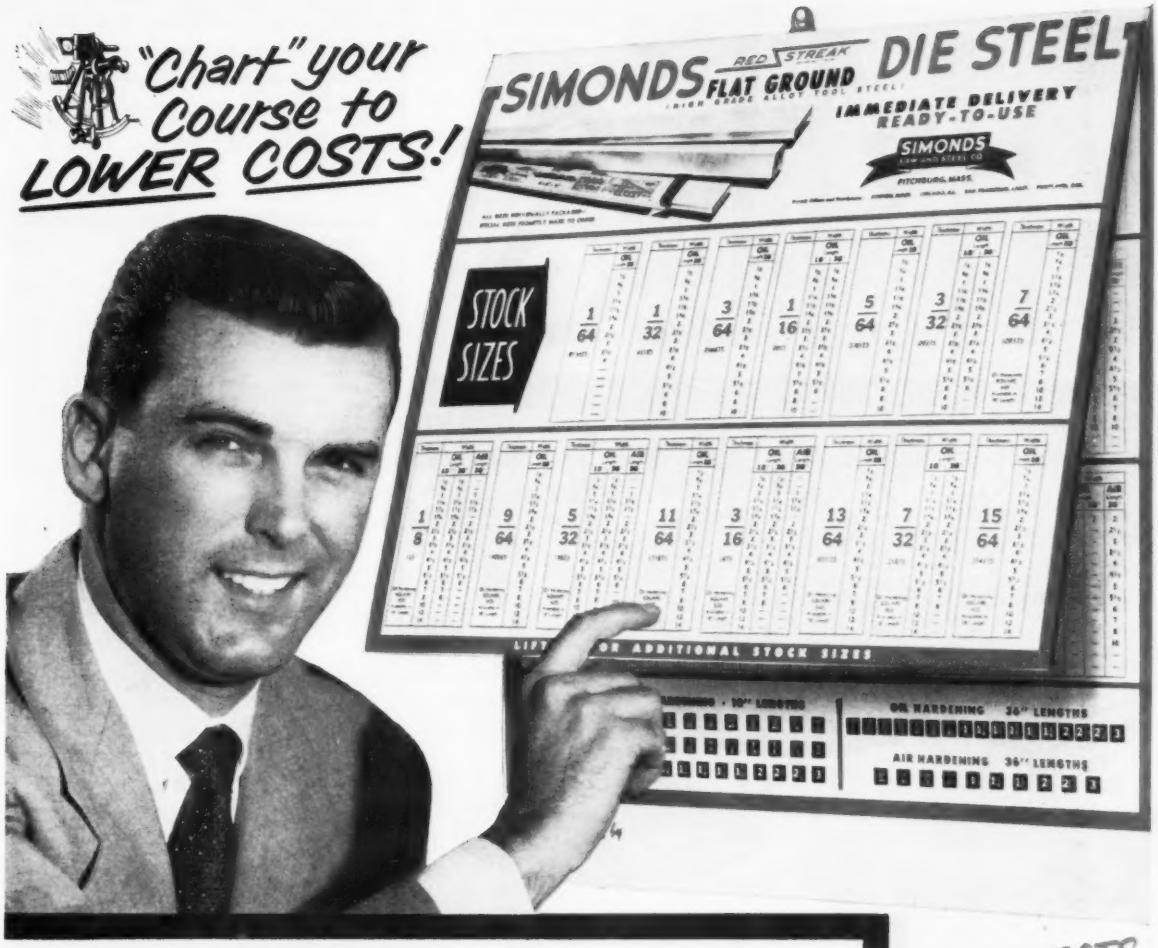
MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

(*Continued on page 348*)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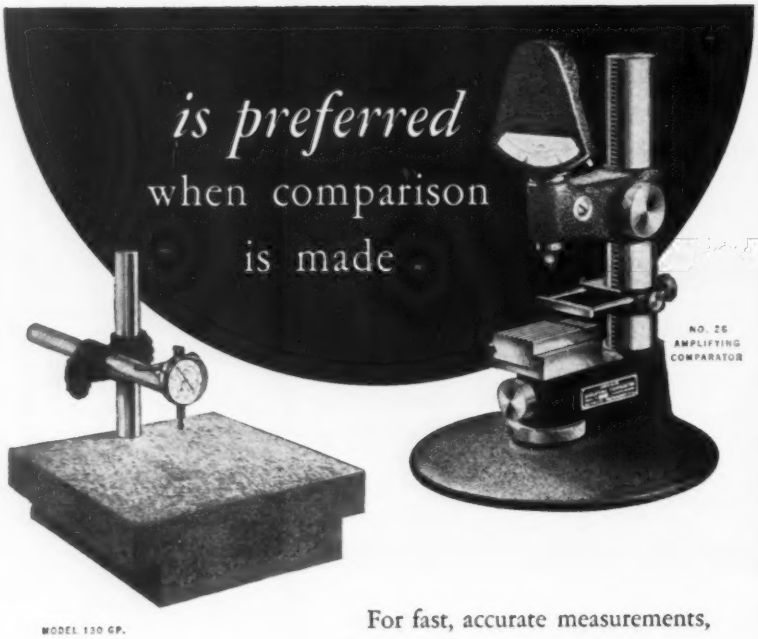

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Kearney & Trecker Corp., Milwaukee, Wis.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Ferndale, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.

MILLING MACHINES, Knee Type Ram

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type, Turret

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

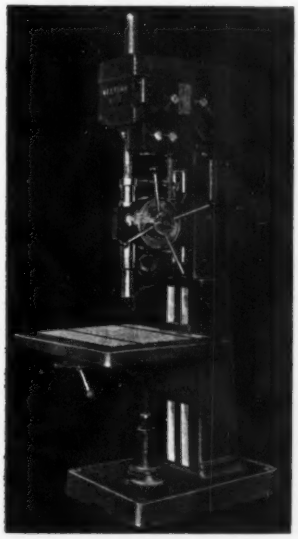
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
South Bend Lathe Wks., South Bend 22, Ind.

MILLING MACHINES, Planer Type

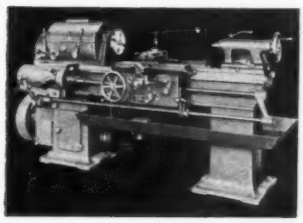
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio

(*Continued on page 350*)

WESTERN UPRIGHT DRILLS —Single or multiple spindle; 18 speeds; 9 feeds; all geared; up to 2½" capacity.



CHARD LATHES — Quick change, geared head; 16", 18" and 20" swing, 8 or 12 speeds.



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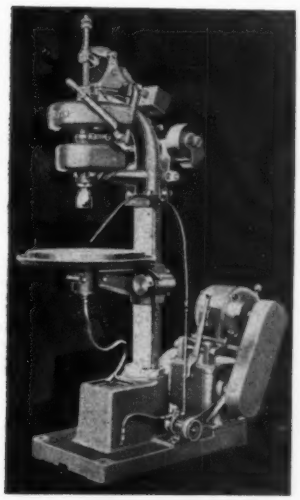

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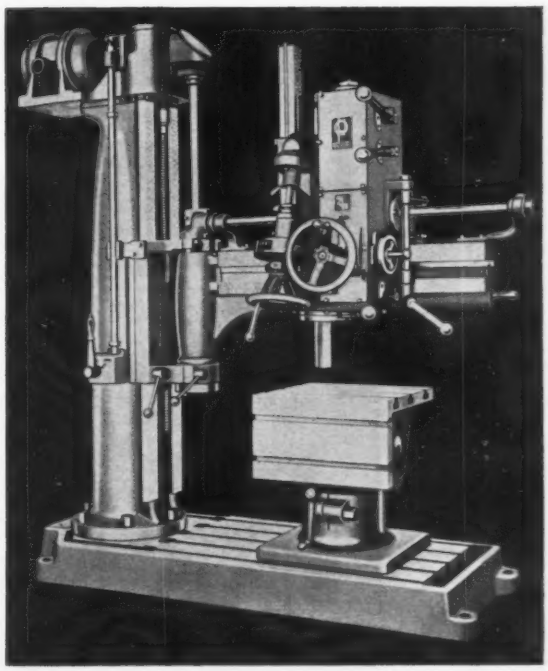

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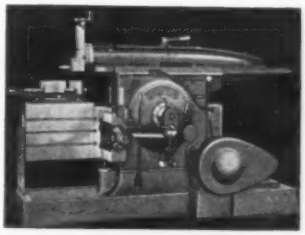

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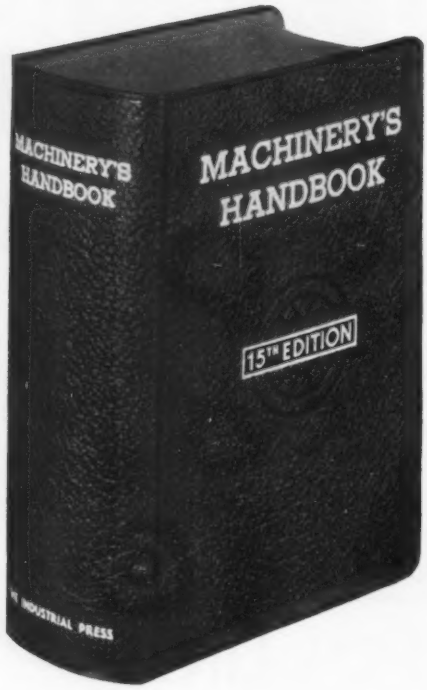

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Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

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Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
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Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

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Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Lees-Bradner Co., The, Cleveland 11, Ohio

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., Roselle, N. J.

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General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

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Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
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Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
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(Continued on page 352)

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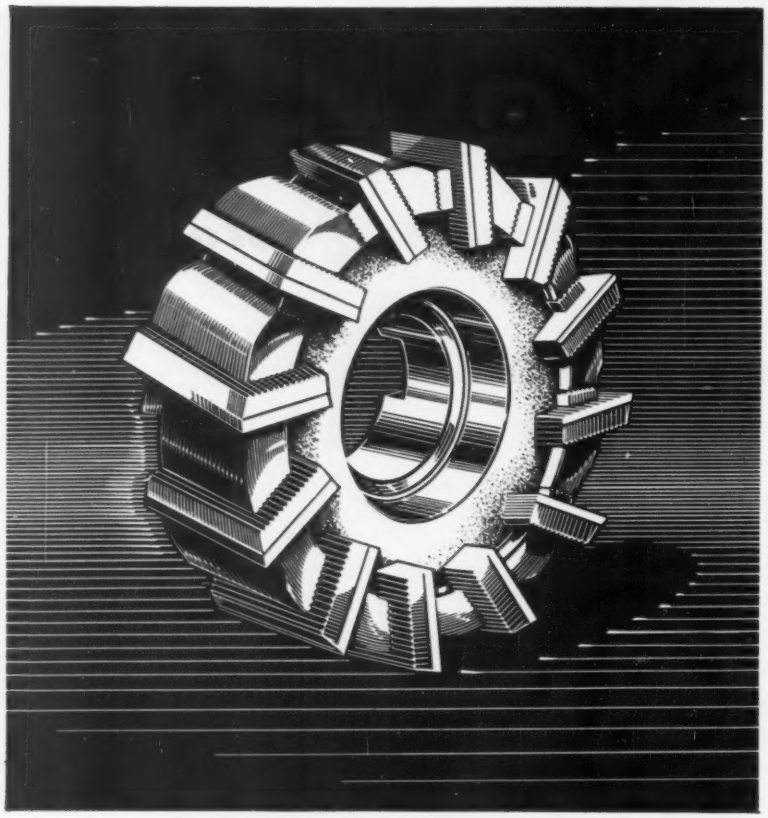

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Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
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Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
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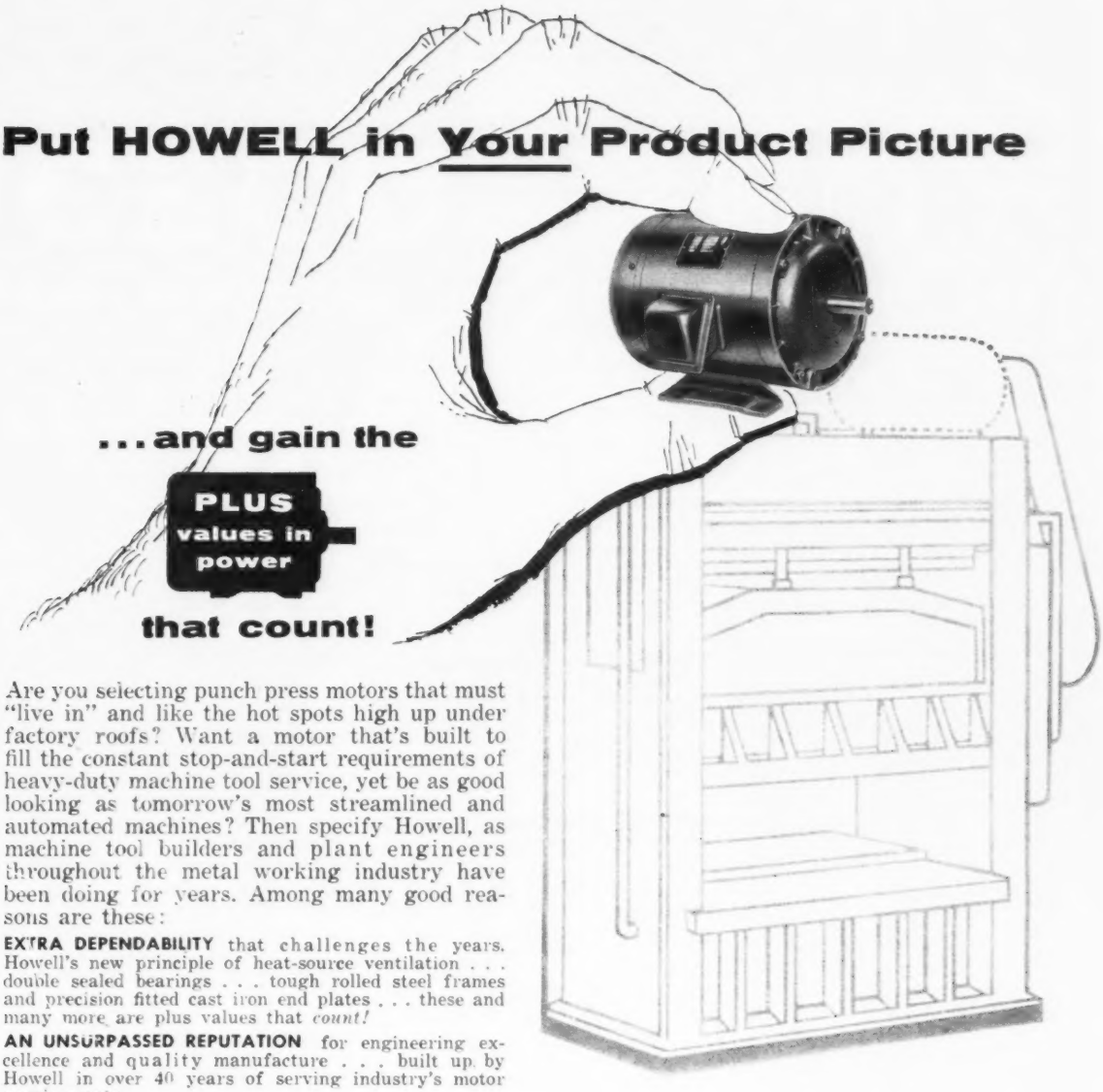

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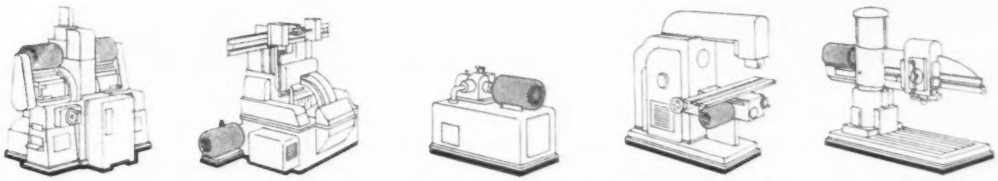

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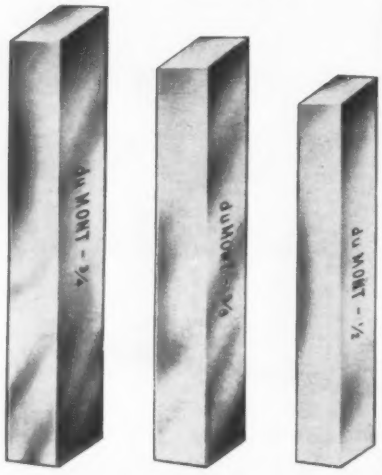

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Yoder Co., 5504 Walworth Ave., Cleveland 2,

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Federal Press Co., 511 Division St., Elkhart, Ind.
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Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
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du Mont Corp., Greenfield, Mass.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
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Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo, N. Y.

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(Continued on page 356)

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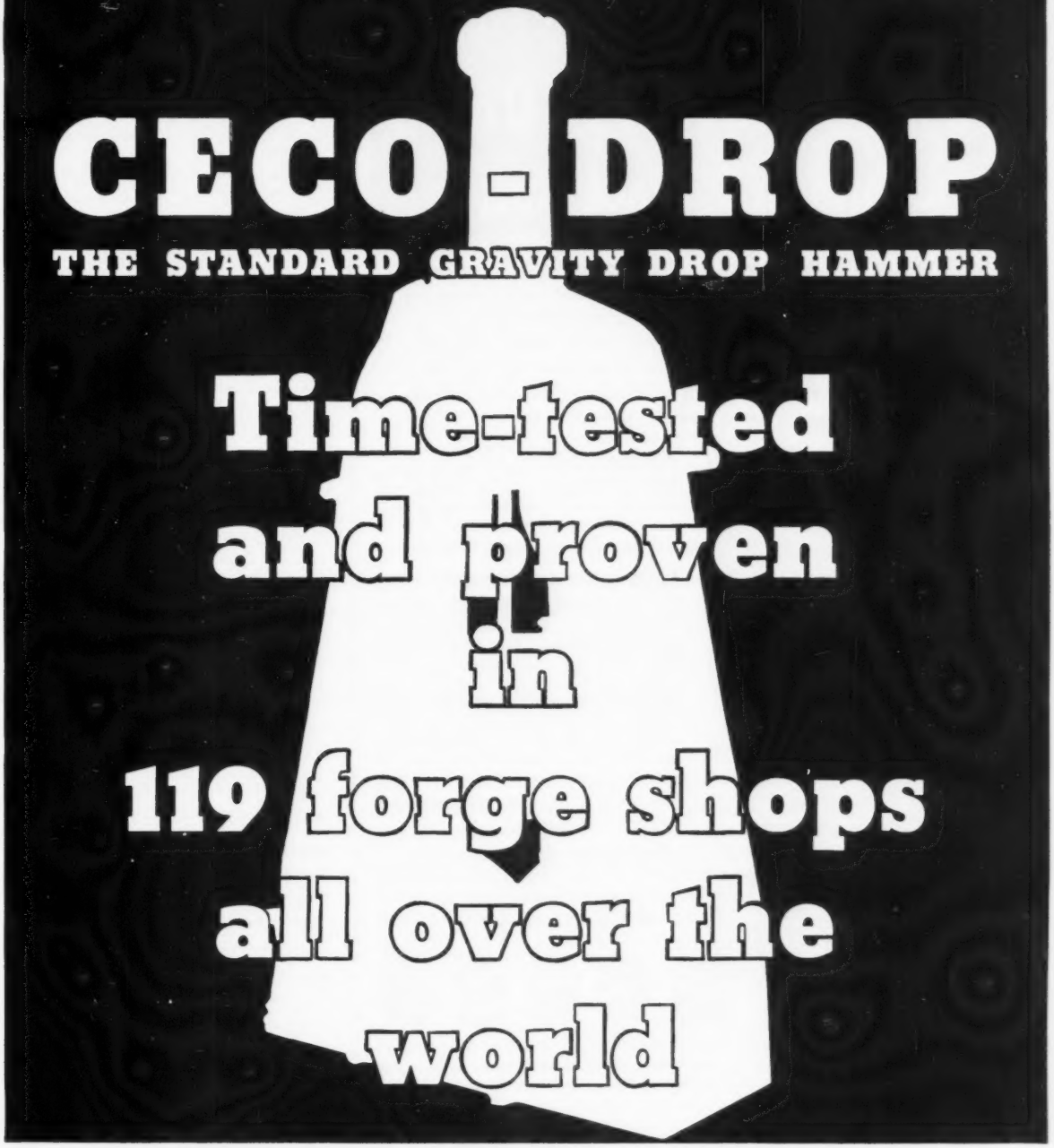

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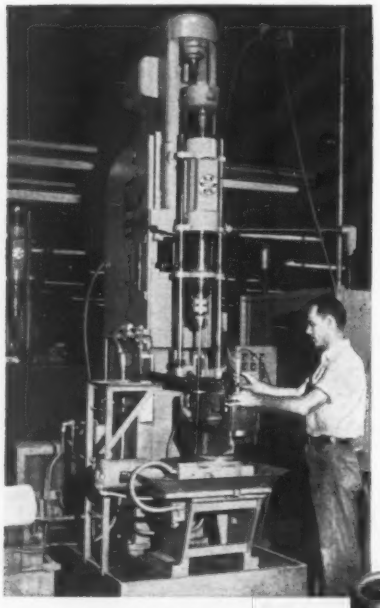
WHY Emerson Electric MICROHONES Laminated Steel Rotors

The Emerson Electric Manufacturing Company is constantly searching for the best possible processing methods. Working with Micromatic engineers on problems encountered in processing shaft holes in their laminated steel rotors, Emerson Electric found that Microhoning would provide much higher production quality while lowering processing costs. The following Microhoning benefits are now obtained:



Model 728 Hydrohoner with automatic Microsize, Microdial and two station rotary indexing fixture. Hole Tolerances: Diameter .0002 inch, straightness and roundness .0001 inch.

CUT REJECTS
With former processing method rejects ran too high. Microhoning controls size and assures a clean hole—rejects are substantially reduced.

ELIMINATED OPERATIONS
Old processing method required two operations. In one operation, Microhoning generates size and straightness within specified tolerances.

REDUCED BALANCING TIME 70%
To preclude vibration and poor operating characteristics, it is essential that shaft hole be concentric with O.D. of rotor. Microhoning reduced by 70% the amount of dynamic balancing correction required.

PROCESSING COSTS CUT 70%
Current figures show the cost of Microhoning shaft holes in rotors to be less than 30% of processing by old method.

Rotors (from 2¼ to 4 inches long) are all Microhoned on the same machine by changing adaptor in fixture and resetting stroke length.

Learn why Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

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L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 18th St., East Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp. 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging
Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp. 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Coining, Embossing
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp. 620 W. Indiana Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Die Sinking (Hobbing)
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Hydraulic Press Mfg. Co. Mount Gilead, Ohio
Lake Erie Engineering Corp, 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Products Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Baird Machine Co., 1700 Stratford Ave., Stratford Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Federal Machine & Welder Co. 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., Paddock Rd. & Tennessee Ave., Cincinnati, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mgf. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Products Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Horning

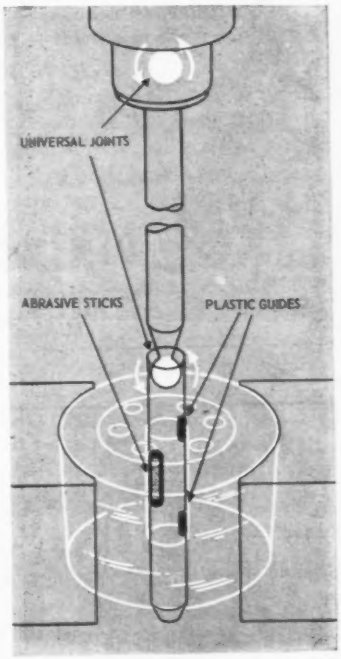
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.

(*Continued on page 358*)

HOW MICROHONING Laminated Rotors Cuts Processing Costs

Emerson Electric squirrel-cage rotors are made of special "electrical grade" steel laminations and each lamination is coated with oxide insulation. In processing the rotor, the O.D. is turned concentric with the shaft hole. Then, in one operation, Microhoning accurately generates finished size and straightness of shaft hole without any change in hole location.

The Micromold tool has two universal joints in the drive shaft which allow the tool body to align itself with the shaft hole. Microhoning of holes is along same axis from which O.D. was turned.



For electrical and mechanical efficiency, assembled motors must have a uniform air-gap between rotor and stator of .006 inch to .011 inch. Because laminated surface is rough and close tolerances must be held, special guided Micromold tools are used. Plastic guides above and below abrasive sticks, control dressing of abrasive and assure generation of round, straight shaft holes.

Before installing Microhoning equipment, two operations were required to finish shaft hole—rejects ran high. Microhoning greatly reduced the amount of dynamic balancing correction required.

The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

YOUR PUMPING JOBS *start fast and finish fast* **WITH VIKING PUMPS**

When you install Vikings, there's no wasted time with slow, uncertain priming . . . you start delivering in seconds. Delivery is then smooth and constant. There's no spasmodic operation to cause damage to valves and meters. And to finish, you can strip a tank fast and completely with positive Viking Rotary Pumps. They are built to pump all liquids, thick to thin.

To start, send today for pump catalog 57Sj.

VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. In Canada, it's "*ROTO-KING*" pumps

See our catalog in Sweets

TOWNSEND of Hartford

LOW COST AUTOMATION

Townsend's engineering, development and manufacturing facilities have an established record of efficiency and customer satisfaction. *Look to Townsend* for the answer to your next production problem.

CLEVELAND TAPPING* special index type machine for drilling, spotfacing, milling and tapping.

*subsidiary of H. P. TOWNSEND

TOWNSEND of Hartford now has a complete line of automatic machines to fit every production need: Automatic screw machines, Riveters, Spring presses, Drilling machines, Duplex spline milling machines, Automatic metal sawing machines, Lead screw tapping machines, Automatic drilling and tapping machines.

The H. P. TOWNSEND MANUFACTURING CO.

HARTFORD 10, CONN.

Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Notching

Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippet Co., 345 Payne Ave., N. Tonawanda, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Bath Cyril Co., 32324 Aurora Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippet Co., 345 Payne Ave., N. Tonawanda, N. Y.
Wiedemann Machine Co., 4272 Wissahicken Ave., Philadelphia, 32, Pa.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Hannifin Corp. 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

Birdsboro Steel Foundry & Machine Co. Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio

(Continued on page 360)

For more information fill in page number on Inquiry Card, on page 257

For the man with a carbide problem and a ceramic future

The production man who teams carbides with worn, obsolete equipment is a glutton for punishment. He's working with a monkey wrench that throttles production and breaks tools.

Carbides won't work with machinery that lacks power, speed and rigidity. And ceramic tools, with their vast production promise for the future, are even more particular about the company they keep. They demand even higher speeds . . . closer tolerances . . . vibration-free equipment.

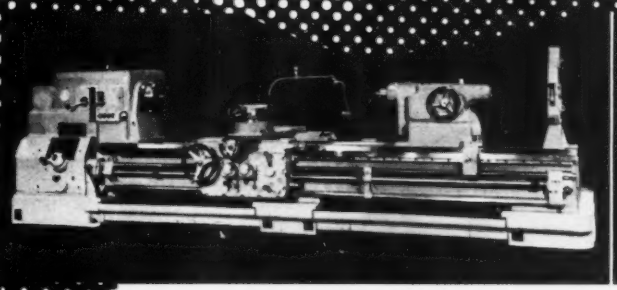
Axelson's new 4025 Heavy-Duty Lathe handles heavy cuts with accuracy that minimizes metal removal in ensuing operations. It thrives on big, healthy bites or small, precision cuts.

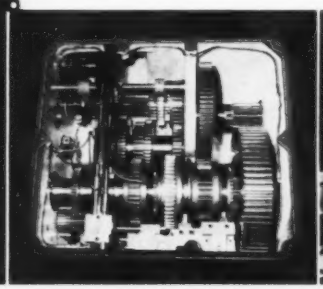
The 24-speed headstock delivers 75 h.p. (up to 100 h.p. for peak loads) throughout spindle speeds that range from 6 to 750 r.p.m. in true geometric progression.

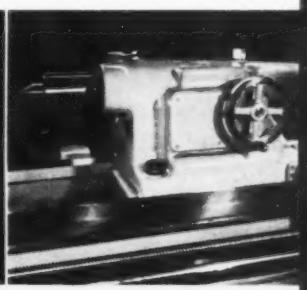
The 4025 Heavy-Duty Lathe has a massive main bed casting to subdue the forces of heavy turning. The carriage bed ways are hardened and ground alloy steel.

Just two levers control a choice of 81 feeds, all contained in a totally enclosed gear box. Axelson's oil-tight, box-type apron runs shafts and gears in a continuous oil bath. All carriage controls are on the apron, right at hand level. The tailstock on Model 4025 is a sturdy, one-piece casting.

Axelson's 4025 Heavy-Duty Lathe is packed with the power, speed and rigidity you need . . . for today's carbides, for the ceramics of tomorrow. Put it to work on your team. Write for Bulletin M3-5504.







HEAD FULL OF POWER
. . . for carbides and ceramics. Twenty-four speeds. Up to 100 h.p. for peak loads.

BUILT TO TAKE IT
Sturdy one-piece casting. Two speeds for rapid or slow powerful movement.

AXELSON LATHES

AXELSON MANUFACTURING COMPANY

Division of U. S. Industries, Inc.
6160 S. Boyle Avenue, Los Angeles 58, California

A Job For A TWO-HEADED MONSTER

PLANT SUPERINTENDENT, THE CINCINNATI GEAR CO.

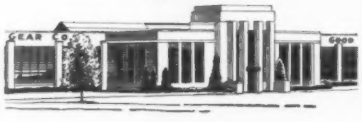
Some of the men here look on me, I'm sure, as a modern Simon Legree with a nine-foot bullwhip — which isn't really a true picture at all. In fact, I think I'm pretty easy to get along with.

But there are times when I think this job of plant superintendent calls for someone with the attributes and physical characteristics of a two-headed monster. To keep track of a couple hundred different men, working on almost as many different jobs and different machines, all involving a high degree of skill and exacting accuracy, requires something more than mere attentiveness to duty. It means I have to constantly put forth an *extra* effort to do a top-notch job.

Not that I'm trying to brag about myself; my job is tough and sometimes it seems thankless, but it has its compensations. And one of the most important of these compensations is the satisfaction of knowing that my efforts are not being wasted. Because *everyone else* here is "putting out" to do *his* part too, with the result that we have a top-notch Company turning out a top-notch product — something that our customers have come to expect from us as a matter of course.

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
Fifty Years of "Gears—Good Gears Only"

CINTI



Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Erie Foundry Co., 1253 W. 12th St., Erie 6, Pa.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Johnson Machine & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Engineering Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machine, Die Sinking, etc.

PULLEYS
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., Paddock Rd. & Tennessee Ave., Cincinnati, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers', Taper, Shell, Adjustable, etc.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Goddard & Goddard Co., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REELS, Stock
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnaces
Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, Etc.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

RIVETERS, Portable
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 510 So. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

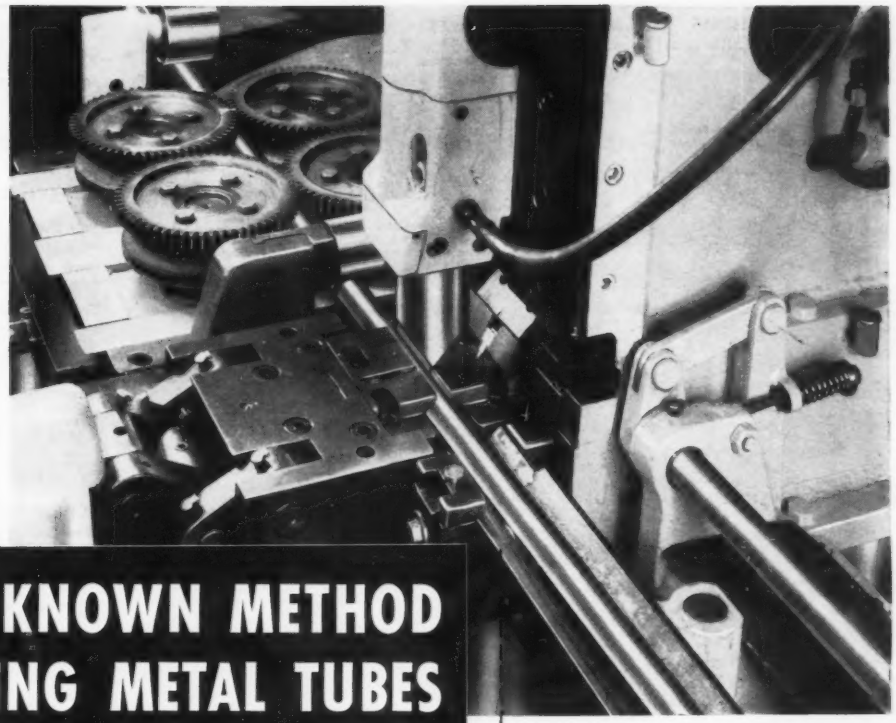
RULES, SCALES AND STRAIGHTEDGES—See Machinists' Small Tools

RUST INHIBITORS
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular, Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen Lucas Mch. Works, Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Tannewitz Works, Grand Rapids, Mich.

SAW BLADE SHARPENERS
DoAll Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.



FASTEST KNOWN METHOD OF CUTTING METAL TUBES

Automatic continuous operation of up to 6,500 cut-offs per hour is approximately 3 to 8 times greater than the speed of competitive methods.

Cutting action in Grieder Tube Cut-off Machines is accomplished by two blades actuated by a crankshaft. A horizontal cut is made first, through the wall thickness of the top of the tube. The vertical blade descends into the opening and completes the cut. The tubing is held firmly in dies which operate as a vise preventing any distortion. Lengths can be held to plus or minus .002″ on light wall tubing and to approximately .003″ on heavier wall tubing.

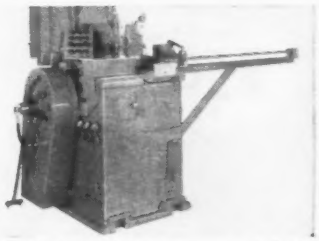
Automatic hoppers for feeding tubes and related automation equipment are available in conjunction with Grieder Tube Cut-off Machines for specific applications. Tell us what you want to accomplish.

Grieder Tube Cut-off Machines are slicing tubes and slashing costs in most major industries. Write for literature.

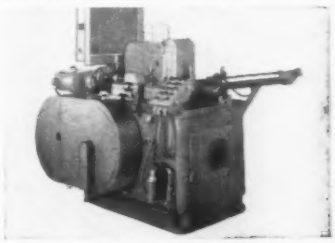
GRIEDER INDUSTRIES, INC.

P. O. BOX 169, BOWLING GREEN, OHIO

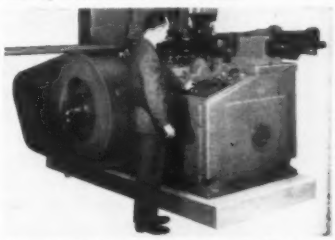
THREE STANDARD MODELS



NO. 1000-MAC cuts tubes up to ¾″ OD and up to .062″ wall thickness.



NO. 2000-MAC cuts tubes up to 2″ OD and up to .125″ wall thickness.



NO. 4000-MAC cuts tubes up to 4″ OD and up to .250″ wall thickness.

For more information fill in page number on Inquiry Card, on page 257

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Tannewitz Works, Grand Rapids, Mich.

SAWING MACHINES, Circular Blade

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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio

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Chicago Pneumatic Tool Co., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

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Hydroway Scales, Inc., 31302 Stephenson Hwy., Madison Hts., Mich.

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Cross Co., 3250 Bellevue, Detroit 7, Mich.
D & L Tool & Machine Co., Detroit 17, Mich.
Errington Mech Lab., Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Thor Power Tool Co., Aurora, Illinois
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

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SCREW MACHINES, Single-Spindle Automatic

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., N. Y. 17, N. Y.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

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Greenfield Tap & Die Corp., Greenfield, Mass.

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Parker Kalon Div., Clifton, N. J.

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Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Thomson Ind., Inc., Manhasset, N. Y.

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Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Homestrand, Inc., Larchmont, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
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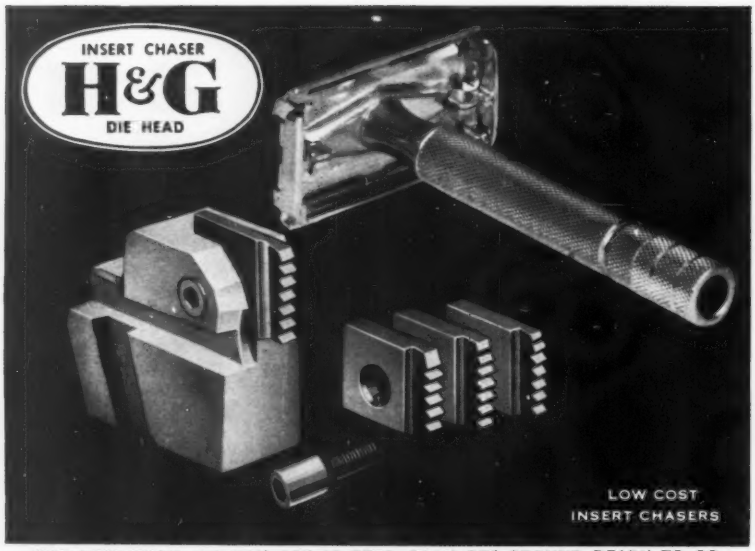

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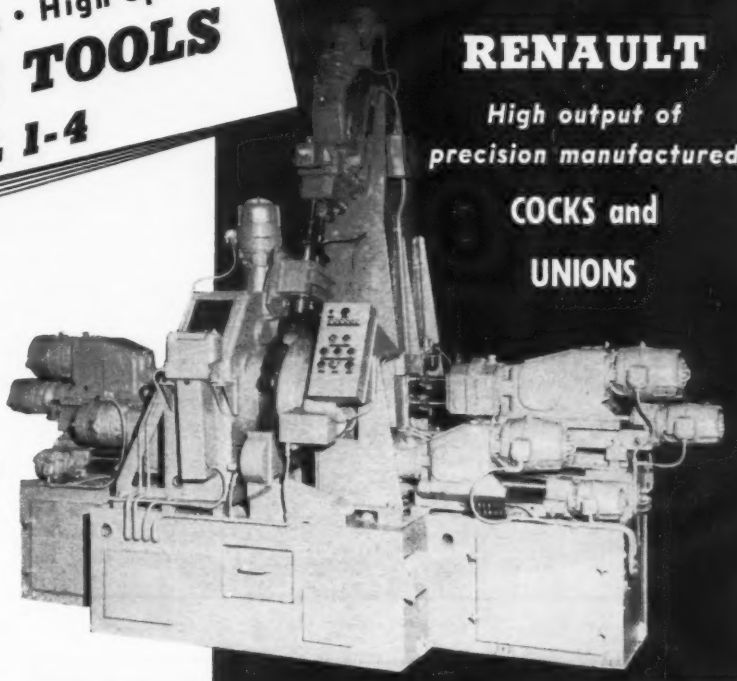

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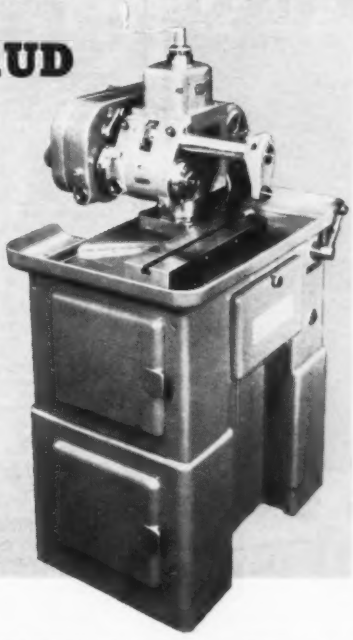

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Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Cincinnati Shaper Co., Hopple & Garrard, Cincinnati 25, Ohio
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkhart, Ind.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

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Lodge & Shipley Co., The, Cincinnati 25, Ohio
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Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.

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Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

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(*Continued on page 366*)

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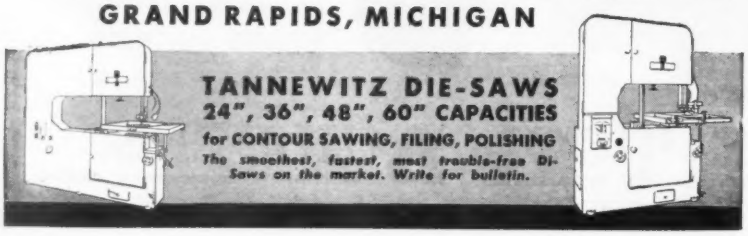
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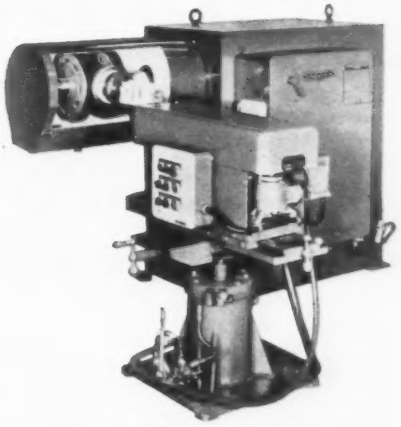

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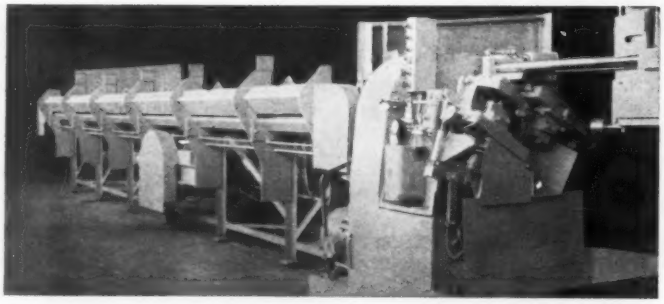

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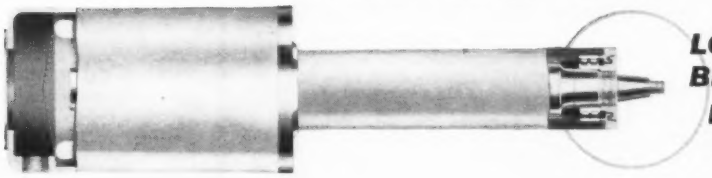

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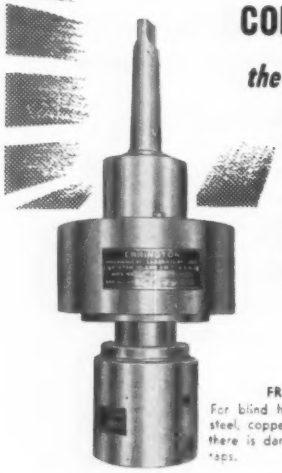

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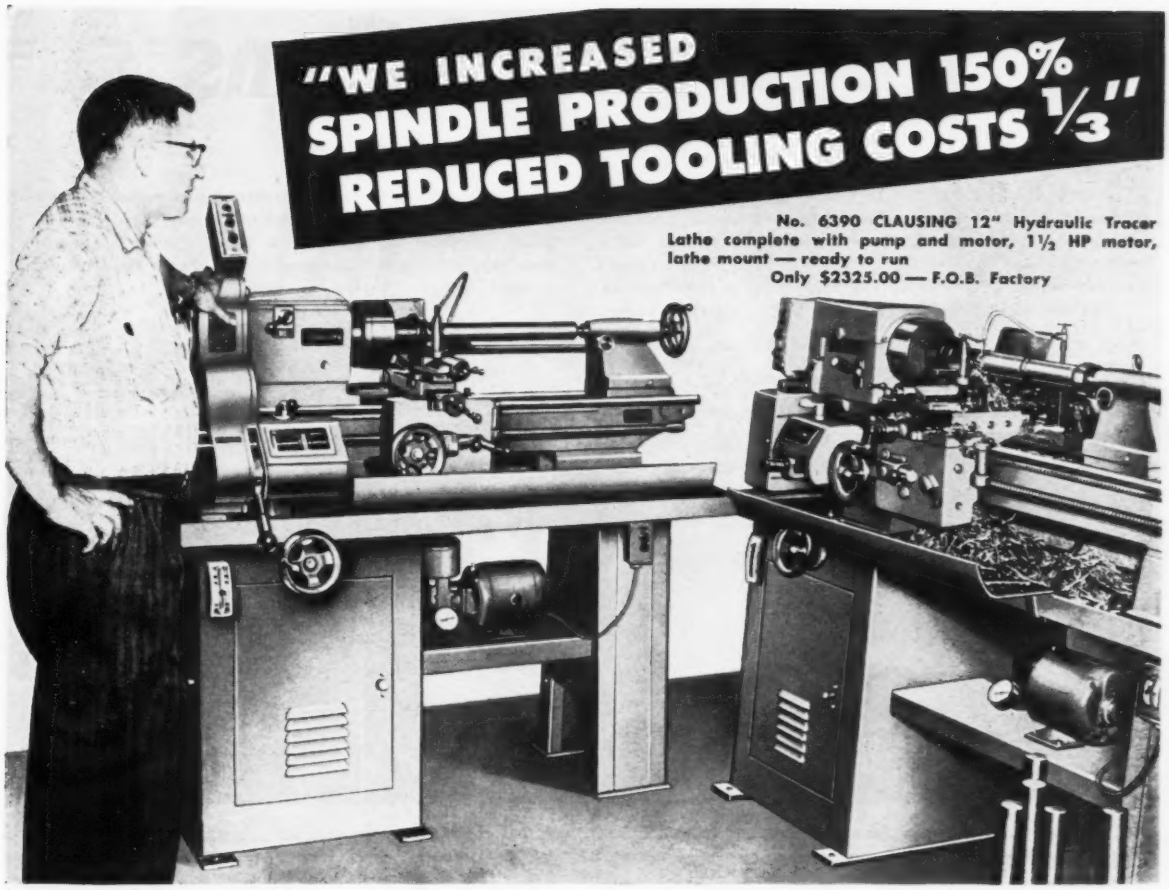
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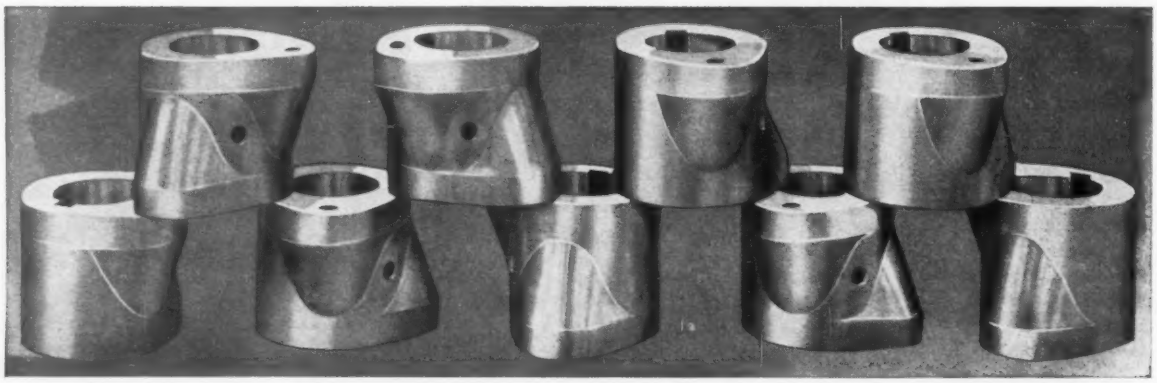

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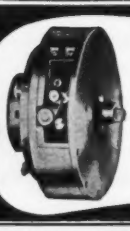

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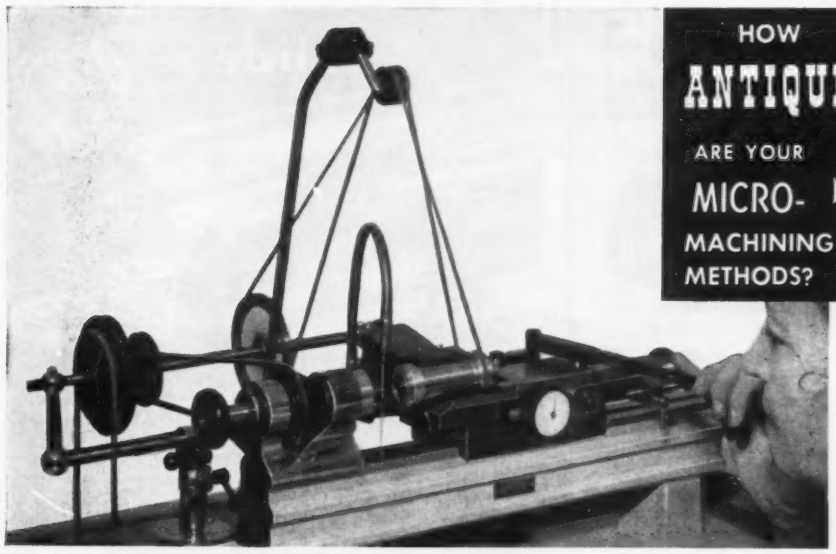

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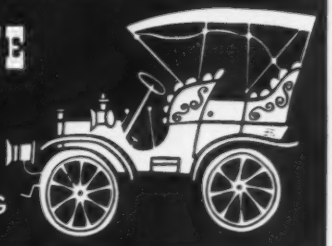

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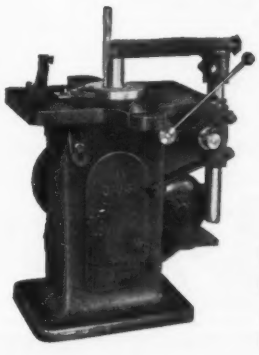

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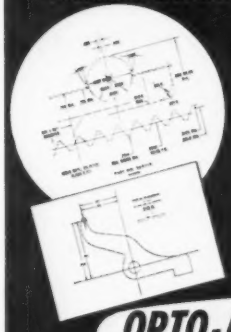

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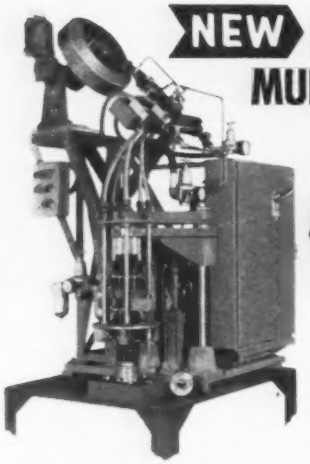

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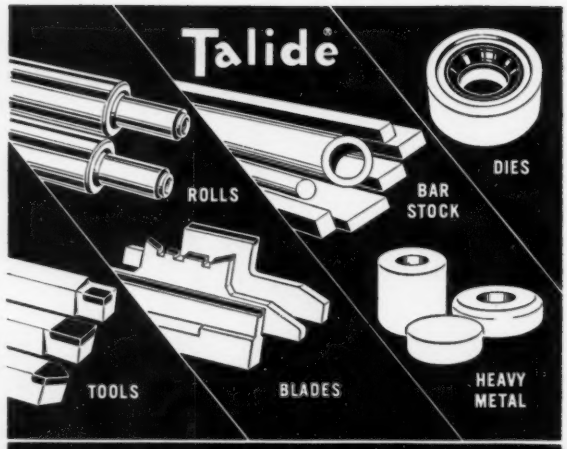

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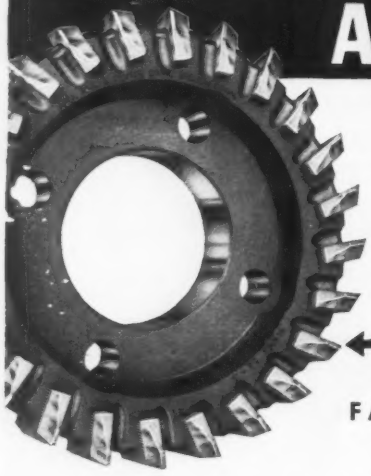

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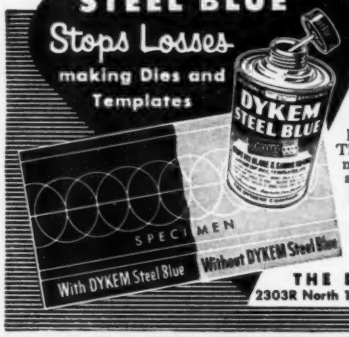

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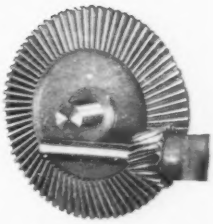

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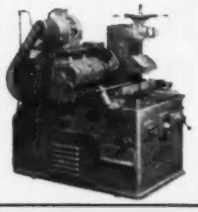

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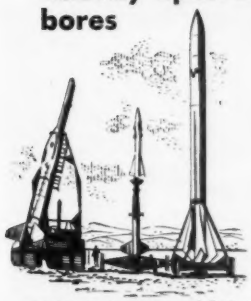

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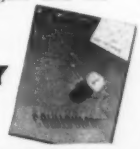

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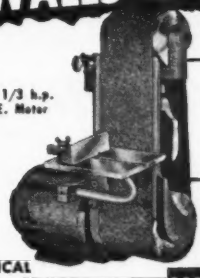

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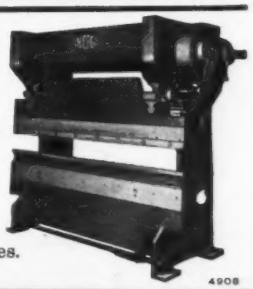

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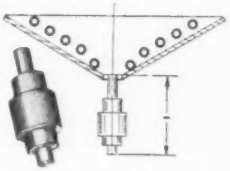

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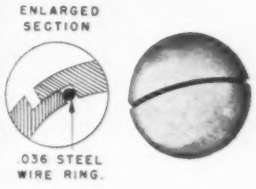

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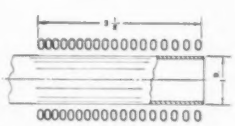

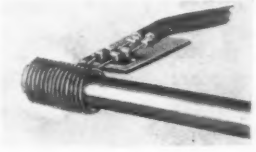

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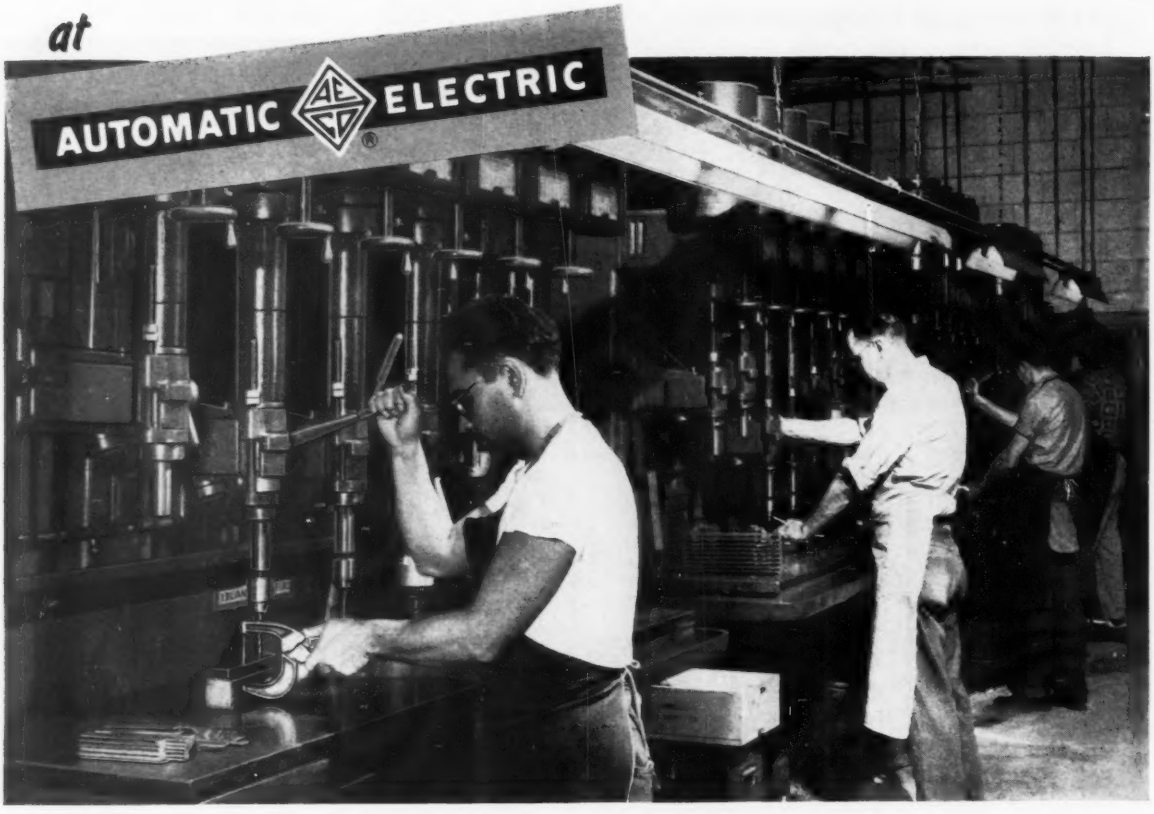

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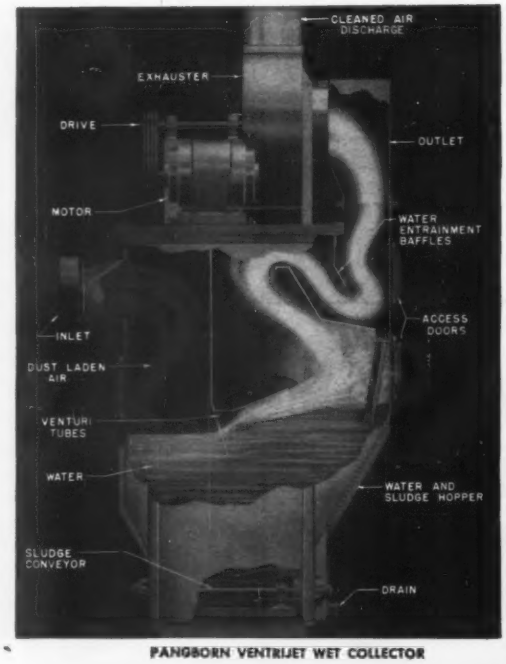

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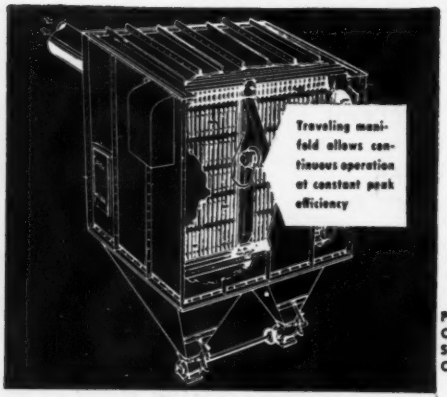

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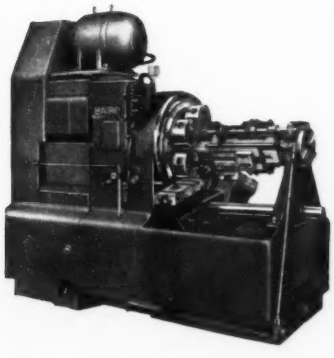

industry's most versatile high production chuckers

To drop from dollars to cents in the unit cost of machining a workpiece is not unusual on a Baird installation. The secret lies in the basic design of this unusual work-rotating machine which permits practical "bug-free" tooling for an almost unlimited range of operations . . . and is equipped for single-cycle or double-indexing, with manual or auto load, auto eject, or full automation as may be required.

On the job illustrated above . . . die cast aluminum starting motor end plates . . . a feature is that only the first two of the six spindles revolve, at which time both sides of the flange are faced, both locating diameters turned, the center hole rough-bored, faced and chamfered, and inside hub back-faced and chamfered. The remaining stations, #3, #4 and #5, are stopped and accurately positioned while powered tools mounted on the tool slides finish-bore the center hole, tap two 1/4-20 holes, and bore one .313-.315 diameter hole off-center.

Sequence of Operations: Face both sides of .421 - .425 flange, turn and chamfer 4.087 - 4.083 and 3.868 diameters, rough and finish-bore .8115 - .8130 center hole, back-face and chamfer inside hub (recessing head), face and chamfer outer hub, tap two 1/4-20 holes, and bore one .313 - .315 diameter hole.

Production: Cycle time 8.55 seconds per piece, 421 pieces per hour gross.

Why not put your high-volume, high-precision jobs on Baird 76H Chuckers? Even where volume is not the whole story, rapid-tooling change-over makes it a most profitable investment. Estimates and recommendations will be given on your prints or samples. Write Dept. M.

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New! Completely redesigned milling machine switches spindle to TIMKEN® bearings

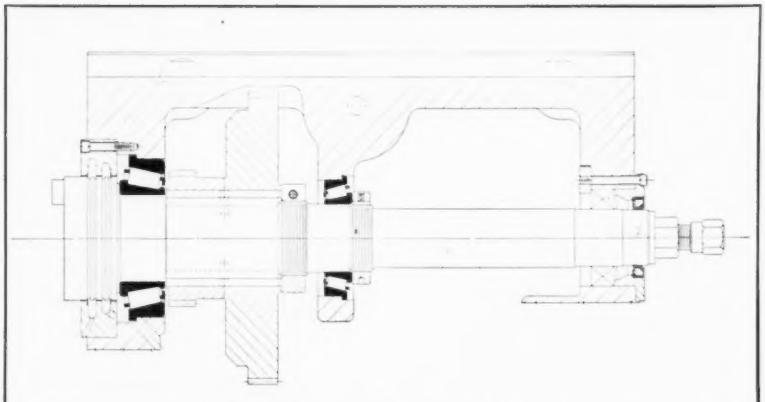
THIS Kempsmith Master-Mill, made by Kempsmith Machine Company, is a brand new, improved model—designed to meet new demands for higher production, lower milling costs. Kempsmith switched to Timken® tapered roller bearings on the new Kempsmith Master-Mill to offer users their many advantages on the spindle, on the table leadscrew, on elevating pinion, and cross feed screw.

Kempsmith reports that Timken bearings are easier to install and adjust, have greater load capacity in small space, are much easier to preload.

Timken bearings hold the spindle in rigid alignment, meeting the requirement of "zero end play over a 24 to 1500 rpm speed range". Tapered construction lets Timken bearings take the radial and thrust loads encountered by a milling machine spindle, in any combination.

Timken bearings were specified, too, because of the heavy shock loads induced by the milling cutter—shocks further amplified by interrupted cuts. Rollers and races in Timken bearings are case-carburized, with tough, shock-resistant cores under hard wear-resistant surfaces. They'll *take* heavy shock loads! And Timken bearings give extra load-carrying capacity with their full line contact between rollers and races.

Geometrically designed for true rolling motion, Timken bearings are precision-manufactured, under rigid quality controls, to conform to their design. We even make our own steel, something no other American bearing maker does. Buying or building machines like this? Look for the trade-mark "TIMKEN" on every bearing! The Timken Roller Bearing Company, Canton 6, Ohio, Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



KEMPSMITH MACHINE COMPANY mounts the spindle of their new Kempsmith Master-Mill milling machine on Timken tapered roller bearings to hold spindle in rigid alignment.

TIMKEN BEARING EQUIPPED

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TIMKEN

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